SCIENTIFIC AMERICAN

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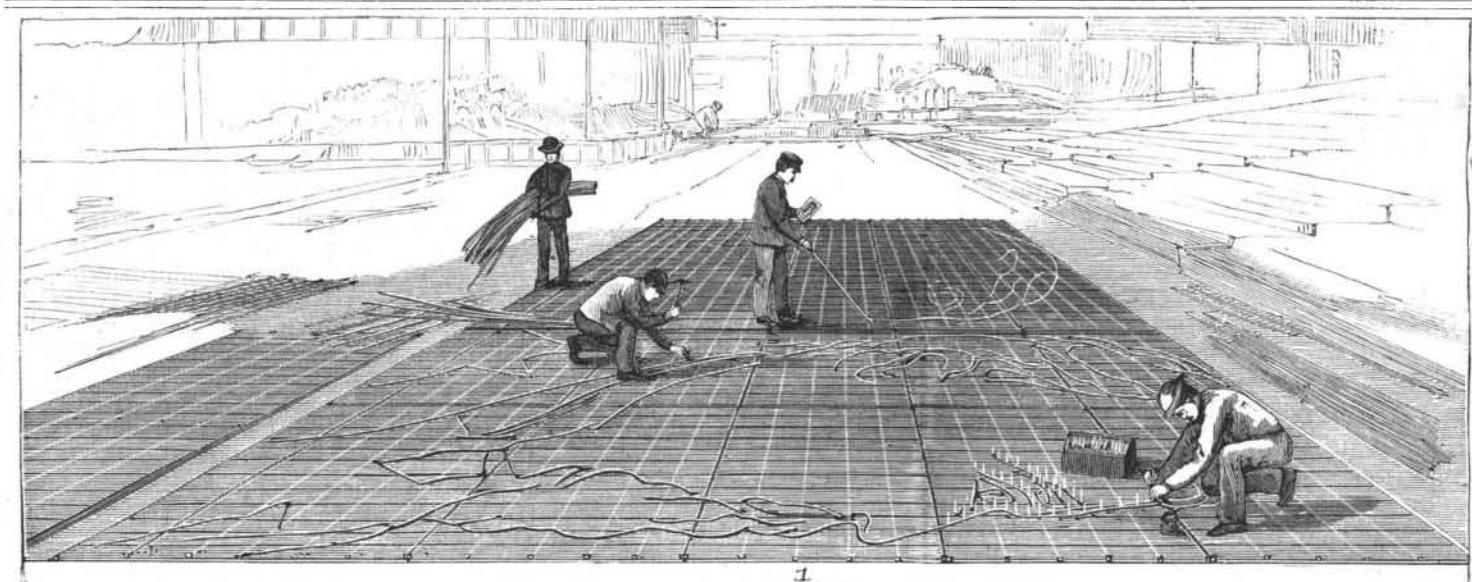

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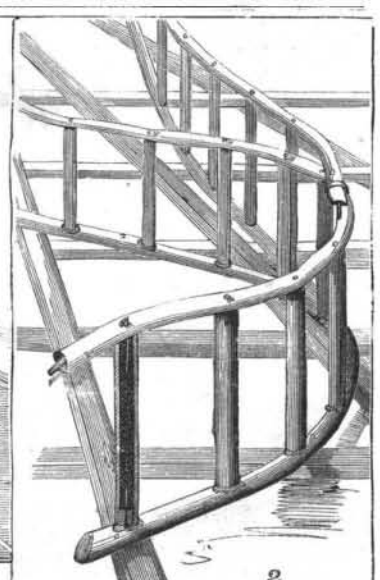

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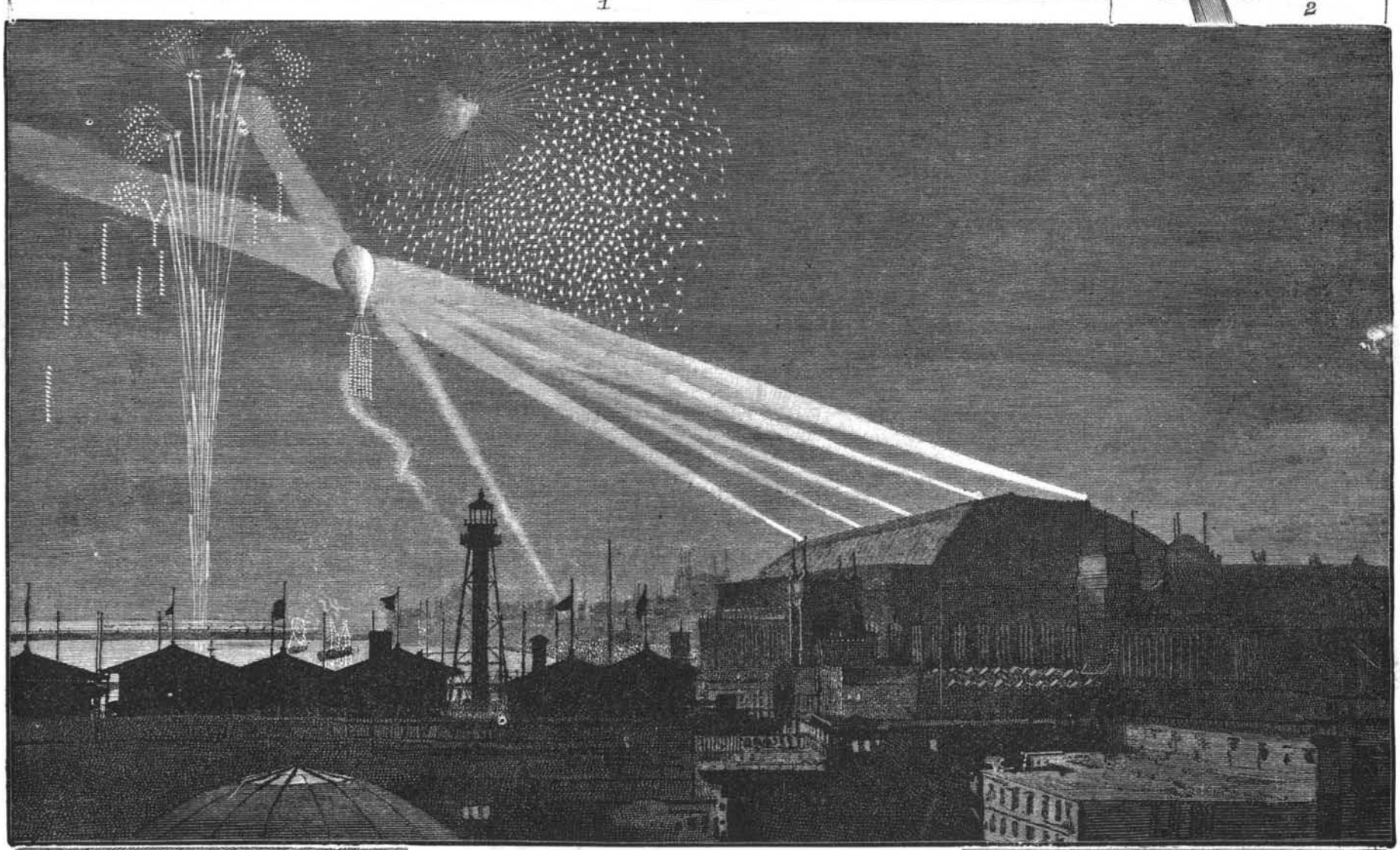

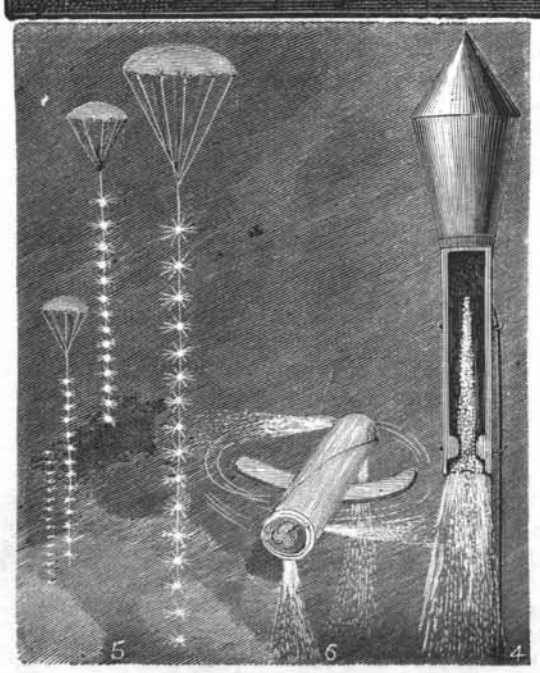

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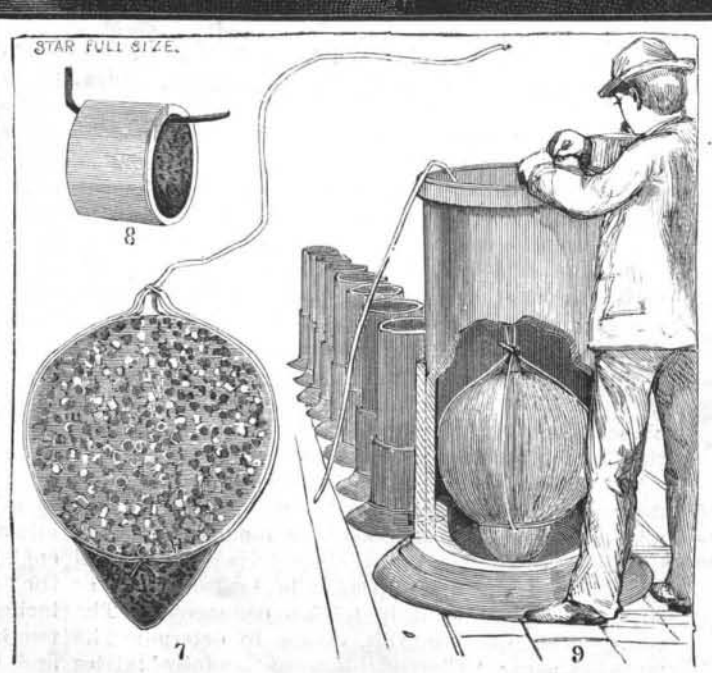

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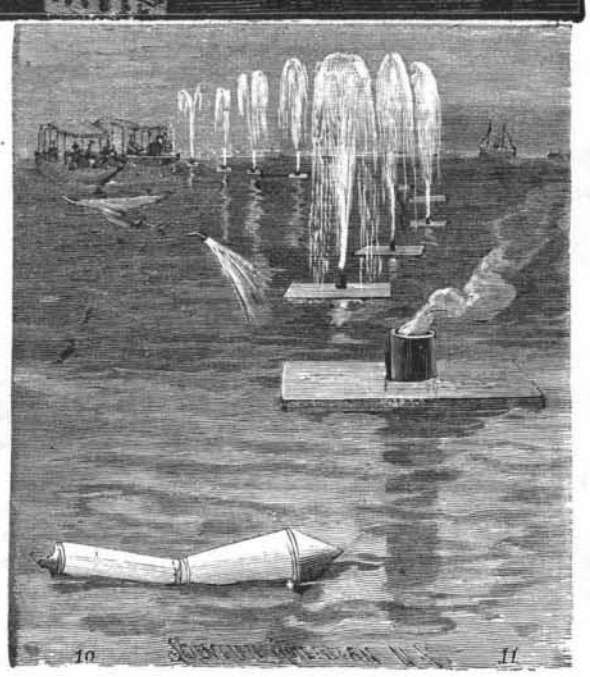

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THE FIREWORKS AT THE COLUMBIAN EXPOSITION—HOW SOME STRIKING EFFECTS WERE OBTAINED.—[See page 359.]

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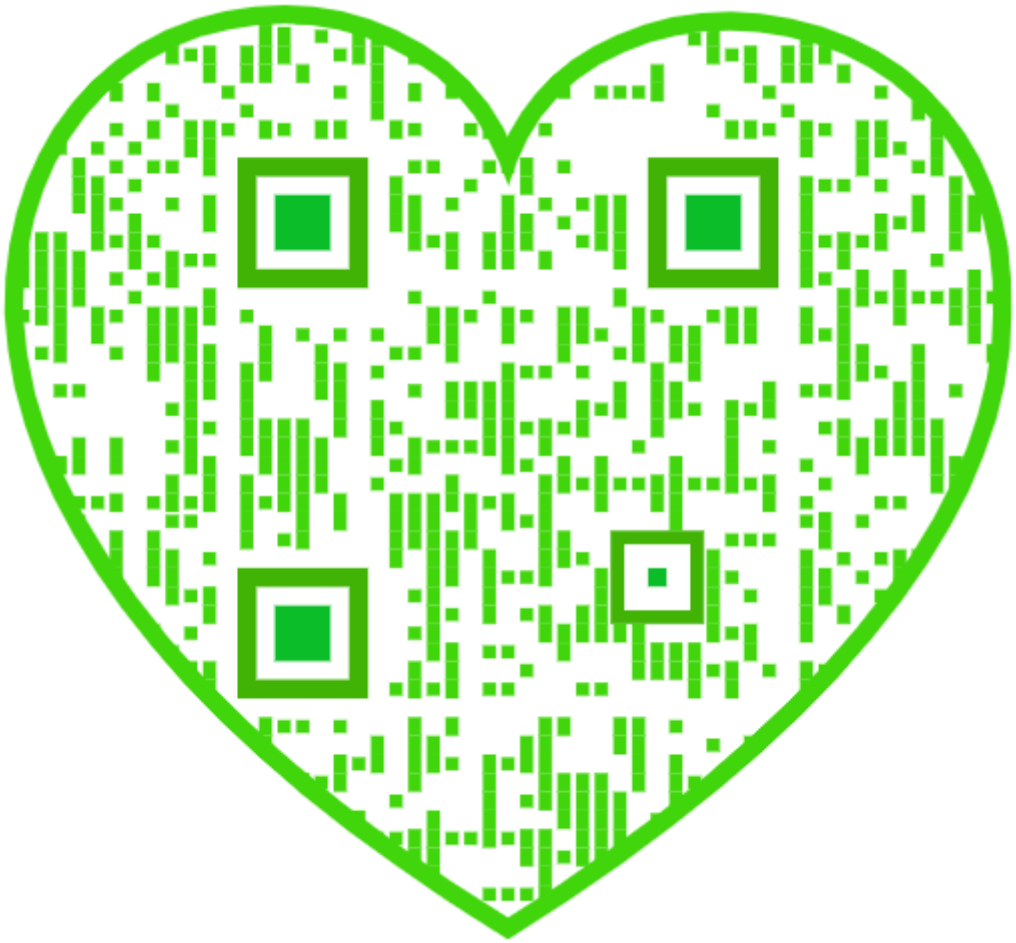

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REPORT OF THE COMMISSIONER OF PATENTS.

The Commissioner of Patents is required to make two annual reports of the condition of the Patent Office, one to Congress, at the beginning of each year, and one to the Secretary of the Interior in the middle of the year.

Commissioner John S. Seymour's report to the Secretary, for the fiscal year ending June 30, 1893, has just appeared, which shows that 39,539 new applications for patents were made during the year preceding, 23,471 patents were granted, 8,283 applications were waiting official action, and the remainder stood rejected or requiring amendment. The total receipts were $1,288,809 and the expenses $1,111,442.

The Commissioner strongly recommends a philosophical classification of the issued patents in order to facilitate the work of official examinations; also the establishment of a more comprehensive scientific library; also provisions for a systematic examination of existing industries in all parts of this country. All these are excellent suggestions, and if carried out would greatly add to the value of the official scrutiny of applications.

The Commissioner further recommends that the supply of free copies of the *Official Gazette* to libraries may be increased, so that inventors may have a more ready access to the publication. The crowded condition of the Patent Office, the wrong thus done to the health of employes, and the great losses to the government from the same cause are strongly set forth and relief urgently asked.

The Commissioner's report has the merit of brevity; while all his recommendations are practical, and their adoption would be of great advantage to the bureau as well as to the public.

THE REGISTRATION OF TRADE MARKS.

The scope of the rights conferred by the registration of a trade mark and the limits of the authority of the Commissioner of Patents in dealing with an applicant for registration are the subjects of a very lengthy decision recently handed down by the Supreme Court of the District of Columbia. The State of South Carolina, under a special law, the so-called Dispensary Law of December 24, 1892, assumed control of the liquor traffic of the State. In virtue of this action it became the owner of a trade mark used in connection with such traffic, and it applied to the U. S. Patent Office for registration of the same.

The case first was passed upon by the Examiner of Trade Marks, who refused it registration on the ground that a State of the American Union is not a corporation as contemplated in the Trade Mark Act of March 3, 1881. He virtually decided that if a State could register a trade mark, then the one in issue could be registered. On appeal the case went to the Commissioner of Patents. He abandoned the examiner's ground for rejection as untenable, and introduced a new and original one of his own. He refused registration on the ground that, even if the State could enter the field of commerce, it had not done so by the legislation (*i. e.*, the Dispensary Act) before him. He says: "Notwithstanding the acts of its Governor and State Board of Control," the State of South Carolina "has no authorized trade in liquors outside its own limits." Therefore he denies the appeal.

The decision of the Supreme Court states what registration of a trade mark does. It gives no new property right, it grants no monopoly of use. The grant differs radically from that conferred by the regular letters patent. It simply confers upon the one registering it the right to sue a citizen of his own State in the federal courts, provided he proves that he uses the trade mark on goods intended for commerce with foreign nations or Indian tribes. There was no question that the State of South Carolina used the trade mark in issue in foreign commerce. The contention of the Commissioner was that such engaging in foreign commerce was unlawful, or outside of the scope of the Dispensary Act, and therefore he refused the registration.

The decision of the Supreme Court says that it does not appear that Congress ever intended to impose upon the Commissioner of Patents the ascertainment and determination of the question whether "the applicant is lawfully engaging in foreign commerce." The Commissioner's duty is to ascertain *prima facie* "whether he (the applicant) is lawfully entitled to use the trade mark sought to be registered, and, in the next place, to ascertain from the showing that is made to him whether that trade mark so lawfully used by the applicant is used in foreign trade." But it will be observed that with the lawfulness of the trade itself the Commissioner has no concern.

The determination of the lawfulness of the commerce in which the trade mark is to be used, the Commissioner must deem imposed upon him by the following clause of the law: "No alleged trade mark shall be registered unless it appear to be lawfully used as such by the applicant in foreign commerce." The court, after quoting this clause to determine its meaning, says: "Clearly this word 'lawfully' relates to the character of the right of the applicant, . . . and not to the character of the foreign commerce." A peremptory writ of mandamus requiring registration of the trade mark was accordingly issued.

The whole decision, which covers over five pages of the Patent Office *Gazette*, is worthy of the most careful reading. It will be accepted as one of the leading trade mark decisions, and we trust will be of use in determining a more liberal treatment by the Patent Office of applicants for registration of trade marks.

TERRIBLE EFFECTS OF DYNAMITE.

The seaport town of Santander, near Bilbao, on the north coast of Spain, was the scene of a terrible disaster on Nov. 3, causing the loss of between two and three hundred lives, with serious injuries also to several hundred other persons, and great destruction of property, including damage to many houses in the town. A Spanish coasting steamer, called the Machichago, with a cargo which consisted of barrels of spirits, petroleum and above fifty tons of dynamite, was unloading at the mole. Some portion of the inflammable cargo took fire. Efforts were made, under the direction of the town police, acting in the presence of the governor, to remove the dynamite and the petroleum, while a steam tug was brought alongside the burning ship, to tow her away from the quay, which was crowded with people. At half past four in the afternoon, probably from the concussion produced by the sudden bursting of the steam boilers, the whole interior of the vessel was shattered, its contents were mingled together, and the dynamite was ignited; there was a series of tremendous shocks. The ship and the steam tug were blown to pieces, scattered over the harbor and the quay, and at least sixty houses, as well as several vessels lying near, and a train at the railway station, were set on fire by the blazing fragments. The governor of the town and several other official persons of rank were among those killed.

Dynamite, as most of our readers know, is a preparation of nitroglycerine, which latter is made by treating glycerine with a mixture of nitric and sulphuric acids. Nitroglycerine is an oil and possesses the remarkable quality of violent explosion when subjected to slight pressure. It is therefore very dangerous to handle. To diminish this danger, and also to present it in the form of a powder, an absorbent substance is mixed with it, which holds the liquid nitroglycerine within its pores and acts as a cushion that prevents the nitroglycerine from exploding under light pressures, such as ordinary handling.

Dynamite is the name given to nitroglycerine when thus protected by an absorbent. Porous microscopic shells, known as infusorial earths, form the best absorbent, and this material is used in the manufacture of dynamite. When dynamite is subjected to sufficient pressure, by concussion, for example, when contained in a bomb which is allowed to fall upon the ground from a suitable height, it explodes with terrific force. The explosive power of dynamite is eight times greater than gunpowder, and in general, for ordinary use for blasting purposes, it is cheaper and safer than gunpowder; but for some kinds of blasting, particularly in coal mining, specially prepared gunpowders are preferred.

The most authentic history of gunpowder attributes its discovery to a German chemist named Berthold Schwarz, some time during the century beginning with the year 1300; and this remained for more than five hundred years the explosive most commonly used, until the invention of gun cotton by Schonbein in 1846 and of nitroglycerine by a French chemist, A. Sobrero, in 1847, in the laboratory of Pelouze, Paris.

The action of nitric acid to render cotton and other substances explosive was discovered by Pelouze in 1838.

NEW BRITISH TORPEDO BOATS OF EXTRAORDINARY SPEED.

The Havock is the name of the first of two new gun boats lately completed by Messrs. Yarrow for Her Majesty' navy, which on a recent trial yielded remarkable speed results. On the three hours' run, in rough weather—the wind blowing 30 miles per hour—a speed of over 26 knots was reached. On the measured mile the mean of four runs was 26·78 knots. The fastest mile run was at the rate of 27·565 knots, and the mean of the best two runs was over 27 knots. This is believed to be the fastest craft afloat The indicated horse power was 3,400, and the engine revolutions 362 per minute.

The boats have twin screws, and generally resemble the first class torpedo boats built by this firm. The length is 180 feet and the width 18 feet 6 inches. There is the usual hood or turtle-back forward, although some modifications have been introduced with a view to getting a drier deck when the vessel is steaming into a head sea. The propellers are three-bladed. The engines are of the usual tri-compound type adopted by the firm, having cylinders 18 inches, 26 inches, and 39½ inches in diameter by 18 inches stroke. The boilers, two in number, as stated, are of the locomotive type, and have copper fireboxes with copper tubes. The total grate surface is about 100 square feet and the total

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heating surface about 5,000 square feet. The deadweight load on board was 35 tons.

A further trial was subsequently had for eight hours at an economical speed, with a view to ascertain the distance the Havock would steam with the fuel supply she can carry on board, upon which depends her radius of action. It was found that at a speed of 11·2 knots the consumption was under a quarter of a ton an hour, and at 10 knots 3½ hundredweight an hour; and as the bunkers have a capacity of 60 tons, it follows that the distance the Havock can steam without coaling is about 3,500 knots.

THE NEW BRAZILIAN NAVY.

It has been interesting to note the mushroom growth, during the past few weeks, of Brazil's provisional navy, a navy built in a day designed to combat a navy which it has taken years to bring together.

In the early part of the present revolution, in Brazil, it became evident to the government party that the only way to dislodge the revolutionists from their stronghold, the ships, was to get and send other ships to meet them. The position, for some time past, in the game between the two parties might be likened to a stalemate in chess. Admiral Mello, the leader of the revolutionary movement, cannot move, and yet he cannot be mated by Peixoto, the President of Brazil.

In consequence of this state of affairs, Brazil, through her minister at Washington, has been purchasing ships and war material in the United States and France, the greater operations being in the United States. The Brazilians evidently recognize the superiority of American skill, and they thus complimented American shipbuilders and ordnance men.

The ships chosen are of a variety of sizes and shapes, and designs, and the armaments are novel.

We have had little or no experience in actual combat with modern war material, and the efficiency and even availabilty of many weapons of modern design are doubtful.

The Chilian civil war gave us a few lessons from actual experience, especially in the use of auto-mobile torpedoes and the small caliber magazine rifles. The interesting feature about the mushroom fleet is that it is to try the dynamite gun, with which our authorities have been so long experimenting, the Howell torpedo, which is said to be equal, if not superior, to the far-famed Whitehead, and the submarine gun, first designed by Ericsson, but since much improved by others as a result of extensive experiments.

The fleet thus largely depends for its offensive qualities on the aerial torpedo, the auto-mobile, aquatic torpedo and the submarine gun. Each of these carries a large charge of high explosive, and, if a successful hit can be made, one of these charges would disable the heaviest and strongest war vessel now in existence.

The preparing, equipping and arming of this fleet has excited much interest, and especially among naval men. Modern naval warfare is at such a point that it is almost impossible to predict the result of any given conditions. Those who are in the position and possessed of the proper knowledge to give the best judgment on the subject are very doubtful of the success of this heterogeneous squadron operating against the fairly well equipped modern ships of Admiral Mello.

President Peixoto must do something, and, as armorclads cannot be purchased in open market nor can they be built in a limited time, the present plan is the only one left to him.

What are the chances of this squadron? First, they must get to Rio de Janeiro. There is no question but that El Cid and the Britannia can get there. The Feiseen and the Yarrow boat will go safely on the decks of the larger steamers, but there is grave doubt about the Destroyer, which is too large to be taken on board of one of the steamers and perhaps too small to go by itself. None of the plans of towing it are satisfactory, and no one is confident of its ever getting as far as the West Indies.

Arriving at Rio de Janeiro, what is to become of this fleet as it approaches the rebel squadron? The long range high powered rifles of the rebels will open fire long before any of the offensive weapons of the attacking fleet can be brought to even a possible effective use. The gunnery practice of the Brazilians being notoriously bad, it is quite possible that the Feissen and the Yarrow torpedo boat, being very fast and presenting small targets, may get near enough to use their automobile torpedoes with effect.

El Cid and Britannia are large targets, and vulnerable to rapid fire guns as well as those of larger caliber, and will find it difficult to get within fighting range. There is no question about the efficiency of their four and seven-tenths inch rapid fire guns, when they arrive within their fighting range, but the dynamite gun cannot be counted on with any degree of confidence at present.

The experiments with the Vesuvius showed how particularly sensitive this gun was to the troubles caused by the unstable platform offered by a ship.

The Destroyer is very slow and cannot be called an efficient boat, and the submarine gun, with which it is armed, though having met with some success lately, is still in the experimental stage.

Though the thorough vulnerability of this fleet must be acknowledged, yet we must not forget that it carries weapons the successful use of which will cause frightful destruction.

It seems to us that President Peixoto must lean heavily for success on the armorclads, Benjamin Constant and Tiradentes, the former of which is an able, well-armed, protected cruiser.

No fleet ever sailed with more chances for and against its success than this provisional squadron, and of the men who go with it, it must be granted that their great pluck deserves good luck.

THE NEW YORK CONTINGENT OF THE BRAZILIAN NAVY.

El Cid, or the Nictheroy, as it has been re-christened, is a new and fast vessel, built to run between New Orleans and New York. She is of 4,500 tons register; length, 380 feet; beam, 48 feet; depth from keel to upper deck, 33 feet; length over all, 406 feet. The Nictheroy is provided with a 43 ton dynamite gun which can throw a 500 pound projectile. She is also armed with several small guns and torpedoes.

The Destroyer is the result of twenty years of Mr. Ericsson's experience in war vessels. She is 130 feet long, 12 feet beam, and has a draught of 10 feet. Her main feature is a 16 inch submarine gun mounted in her bow 8 feet below the water line. The gun fires a projectile weighing 1,525 pounds, being 27 feet 4 inches long, 16 inches in diameter and containing a 300 pound charge of high explosive. A feature of the projectile is a pilot shell, which is detachable, and the object of which is to open a breach of sufficient size through a torpedo net to allow the projectile to pass through.

The Britannia, now known as the Brazilian America, was originally owned by the North Atlantic Steamship Company, of Boston, and made trips between Boston and Halifax. The Britannia was built at Bergen, Norway, in 1890. She is of steel, and is 270 feet long, 34 feet 6 inches beam, and the hold is 23 feet deep. She is well armed. These vessels have lately sailed from New York for Brazil, and their careers in the war will be watched with interest.

The Flying Rocks of Mount St. Helens.

A recent issue of the New York *Sun* contains an account of the ascent of St. Helens, by Mr. Fred. G. Plummer, from which we take the following:

The State of Washington is traversed from north to south by the mountains called the Cascade range. They are the mountains which the early navigators of the North Pacific called the Snowy range, and which were delineated upon our early geographies as the Presidents' range. At that time it was proposed to name the great peaks after the Presidents of the United States, but this revision of nomenclature was a failure.

The Cascade range forms a portion of the longest range of mountains upon the earth. From Cape Horn they run along the west coast of South and North America, along the Aleutian Islands, Kamchatka, Kurile Islands, up the east coast of Asia, through Siam and Sumatra, and thence into the Indian Ocean, where they still make their location known by the volcanic islands Kerguelen, St. Paul, and Amsterdam. Indeed, this great range completely belts the planet on a great circle, and doubtless marks, as has been suggested, the former equator of the earth, for it is conceded that the poles of the earth have changed, that it might be explained how tropical plants once flourished at the poles while glaciers covered Europe. The mass of these mountains came from enormous fissures in the earth's crust, excepting the great true volcanoes which are so numerous along this line.

Within 150 miles of Tacoma are no less than twenty-three of these large volcanoes and hundreds of smaller vents. Mount Tacoma, 44 miles southeast from the city, is 15,000 feet high, and is already famed for its great glacier system.

St. Helens has shown the greatest activity in recent times. In August, 1831, there was an uncommonly dark day, which was thought to have been caused by an eruption of a volcano. The whole day was nearly as dark as night, except for a slight red, lurid appearance, which was perceptible until near night. Lighted candles were necessary during the day. The atmosphere was filled with very light ashes, like the white ashes of wood. The day was perfectly calm. There were no earthquakes or rumblings. After the ash clouds had cleared away it was seen that the pure white snow upon St. Helens was browned by the fall of ashes. It is also said that lava flows took place at that time.

In October, 1842, St. Helens was discovered all at once to be covered with a dense cloud of smoke, which continued to enlarge and move off in dense masses to the east, filling the heavens in that direction. When the first volume of smoke had cleared away it could be seen distinctly from various parts of the country that an eruption had taken place on the north side of St. Helens, a little below the summit, and from the smoke that continued to rise from this crater it was pronounced a volcano in active operation. When the explosion took place the wind was northwest, and on the same day, extending from thirty to fifty miles to the southeast, there fell showers of ashes or dust, which covered the ground in some places so as to admit of its being gathered in quantities.

On November 23, 1843, St. Helens scattered ashes over the Dalles of the Columbia River, fifty miles away, and burned continuously until February 16, 1844. Dense masses of smoke rose from the craters in immense columns, and in the evenings the fires "lit up the mountain side with a flood of soft yet brilliant radiance."

I determined to investigate the most active volcano in Washington.

We left Tacoma by the midnight train on August 10, 1893, with packs containing the necessaries for the trip and the instruments for observing and recording all we were to see.

When we reached the mountain, with the aid of a glass I was able to map out a route to the larger of the craters, which would not cross any of the great crevasses in the ice slopes. Our ascent began immediately, and in less than an hour became very steep and in places dangerous.

Our progress was checked by an enormous cañon, several hundred feet deep, which appeared a counterpart of the grand cañon of the Yellowstone. Its formation showed several old lava flows, which, being firmer than the cinders and broken rock, in most places overhung the walls of the cañon and made descent out of the question. The great glacier at its head was fully 100 feet deep at the foot, and was plowing its way into a huge terminal moraine of small rocks. We could plainly hear the rocks grinding together as the great body of ice slowly forced them down the cañon. This great glacier headed in the ice cap at the summit of the mountain, and, although it looked steep and slippery, we decided to try this route. It was then 10 o'clock in the morning—a bad time to climb ice slopes and snow fields—but we had been gone from Tacoma nearly a week and had only provisions for two more days.

We had proceeded but a short distance cutting steps in the steep ice slope, when a bombardment of rocks warned us that our route was to be a dangerous one. The surface of the glacier seemed a sheet of ice clear to the summit, and down its slippery surface came rocks large and small as fast as the noonday sun melted the ice and snow which held them near the top.

Imagine a toboggan slide about three miles long, starting nearly 10,000 feet above the sea with an initial grade of forty-five degrees. The speed of the rocks as they passed us was terrific. They whirled at such a rate that they seemed spherical in form, and as they flew down the slope seemed only to touch the high places in the slightly wavy surface of the glacier, making a metallic sound as they chipped the ice into a cloud which trailed them like a comet's tail. Here and there great rocks lay upon the surface of the glacier, probably having been held by a fall of new snow, and now and then one of these flying rocks would strike those which were held by the ice, and, amid a shower of sparks and chips, would bound into the air fifty feet or more, still whirling like a buzz saw and giving out a sound which I cannot describe. All this would have been very entertaining if so many of the flying rocks had not passed near us.

We were exposed to this danger for over an hour while climbing a quarter of a mile, and to say that we were all thoroughly frightened would not do the rocks justice. When at last we reached a place of comparative safety, we were too much awed to speak.

A New Deep Water Port.

The commercial interests of east Texas will be advanced by the new deep water port at Sabine Pass, Texas. The bar has been dredged so that vessels drawing 18 feet of water can pass the bar and reach the natural and spacious harbor every twelve hours. Jetties have been constructed on either side measuring 17,100 feet and 14,750 feet, with the walls above high tide. The new harbor will be especially valuable to the lumber and cotton trade. Instead of expensive transfers, cotton can now be shipped to Manchester or London direct. There are extensive deposits of coal in this part of Texas which, it is thought, will now be developed. A deep water celebration was held October 24 in honor of the event.

Curiosities of Science.

The weight of a molecule of hydrogen, as given by an eminent authority, says the *Chemist and Druggist*, is approximately 0·000,000,000,000,000,000,000,04 of a gramme; multiplying this inconceivably small number by 55, the atomic weight of iron, the weight of a molecule of iron is ascertained—0·000,000,000,000,000,000,002,2 gramme. In the sulphocyanide test we are able to detect the presence of thirty-three ten-millionths of a gramme of iron; dividing this number by the weight of one molecule of iron, we find that this apparently delicate test is unable to indicate to our senses a less number of molecules than 1,500,000,000,000,000.

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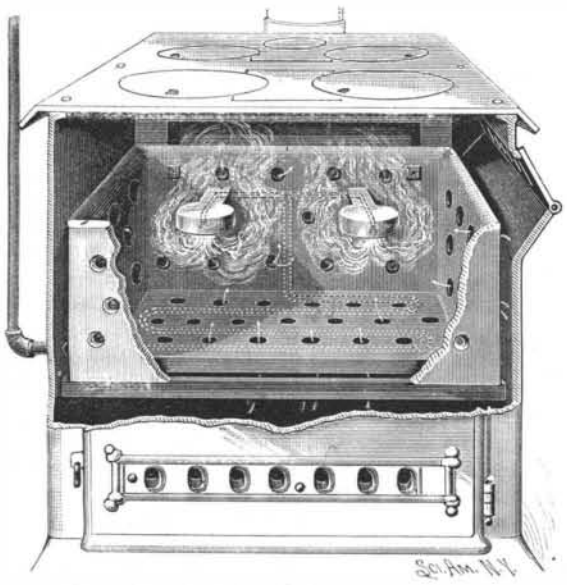
A BURNER FOR COOKING OR HEATING STOVES.

The illustration represents a burner designed for convenient insertion and use in ordinary stoves for cooking and heating purposes. The improvement has been patented by Mr. Theodore A. Williamson, of No. 234 Juniata Street, Allegheny City, Pa. In the fire box of the stove is placed a box with perforated side and bottom plates, sufficient room being left at the back, front, and sides of the box to permit the free access of air for the promotion of combustion, and in the bottom plate of the box is formed a coil connected with a supply pipe leading from an oil reservoir, conveniently located at a safe distance, but so as to afford a ready flow. The coil, instead of being cast in the bottom plate, may be formed thereon by piping or other means, but the inner end of the coil terminates in a vertical channel in the back plate, this channel



WILLIAMSON'S HYDROCARBON BURNER.

leading to branch channels connected with burners, as shown in dotted lines. When the burner is in operation, the heat from it converts the oil passing along the coil and branch channels into gas, and the burners are so placed that the heat therefrom will pass readily to the channels of the stove in the usual way. A transverse, vertically adjustable plate is arranged at the back of the box, to increase or diminish the space between its upper edge and the top plate of the stove, thus regulating the amount of heat passing rearwardly. The improvement is also readily applicable to the ordinary forms of stoves for heating purposes.

EXHIBIT OF JARECKI MANUFACTURING COMPANY.

Jarecki Manufacturing Company, Limited, of Erie, Pa., had an exhibit of pipe-threading tools, malleable iron fittings, cast iron fittings, iron body globe, angle and gate valves, steam brass work, etc.

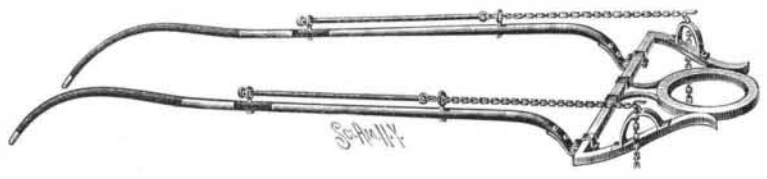
Their exhibit was very tastefully arranged, the large pipe threading and cutting machines being placed along the sides of the space, while in the rear a pyramid had been built to hold malleable fittings. A unique arch constructed of cast iron pipe fittings was built across the rear, towering above the pyramid.

The machines shown are designed to cut and thread pipe from ⅛ to 16 inches in diameter. They were operated in a variety of ways. Some were driven by hand, others by electric motors, some by belt from the Exposition power plants, and others had engines attached to furnish the power. They were shown in actual use, and received much commendation from pipe fitters for their ease of adjustment, convenient arrangement, and good work. The dies are quick opening and adjustable, each set of four pieces cutting two sizes of pipe. A large assortment of Jarecki screw plates and pipe cutters was also shown.

One of the features of the exhibit was a large showcase containing highly polished specimens of globe, angle, check valves, radiator valves, steam cocks, and numerous other steam and water appliances.

A CHEAP AND SIMPLE THILL SUPPORT.

This improvement, patented by Mr. Adolph Meyerhoff, of No. 301 East 83d Street, New York City, may be attached to any vehicle, to hold the thills or pole up as desired, either in an upright or nearly vertical position, as may be convenient, when the vehicle is to be stored, or at about the normal height, to relieve the horse of their weight. Upon the thills or pole are eye-bolts, or keepers, in which slide rods having each a head at its front end engaging the forward keeper, the inner end of the rod being attached to a chain extending rearwardly through the other keeper. Upon metal straps secured to the braces of the running gear, or in other convenient position, are hooks, to which the chain is made fast by one of its links, according to the height at which it is desired to hold the thills, the engagement of the head of the sliding rod with the outer keeper and the straightening of the chain holding the thills in the desired position.



MEYERHOFF'S THILL SUPPORT.

Florida Ants.

There are more ants to the square mile in Florida than in any other country in the world. There are ants that will measure more than half an inch in length, and then there are ants so small that they can scarcely be seen to move with the unaided eye. There are red ants and black ants and troublesome ants. But as bad as they are, I have never heard of them eating out the seat of a man's trousers, as a missionary, the Rev. Mr. Wilson, once told the writer he saw the army ants do in India while the man was sitting on the earth for a few minutes beside him.

But the Florida ants will take out the lettuce and other minute seeds from the soil in which they are planted and actually destroy the beds. They will suck the life out of acres of young cucumbers and melon plants, uproot strawberry plants or cover the buds with earth to such an extent as to kill them. They will get into pie, pickle, sauce, sirup, sugar; on meat, in hash; will riddle a cake or fill a loaf of baker's bread till it is worthless. All remedies failing, I took to baiting them near their nests with slices of meat, bones, apple and pear parings, and when I had from 50,000 to 100,000 out I would turn a kettle of boiling water on them. I have killed a during week over a million in the space of a quarter acre lot, and I have almost wiped them out. I had to do this to secure any lettuce plants, and many unobservant farmers complain of seedsmen when they should attribute their troubles to insects.—*Savannah News.*

A Royal Inventor.

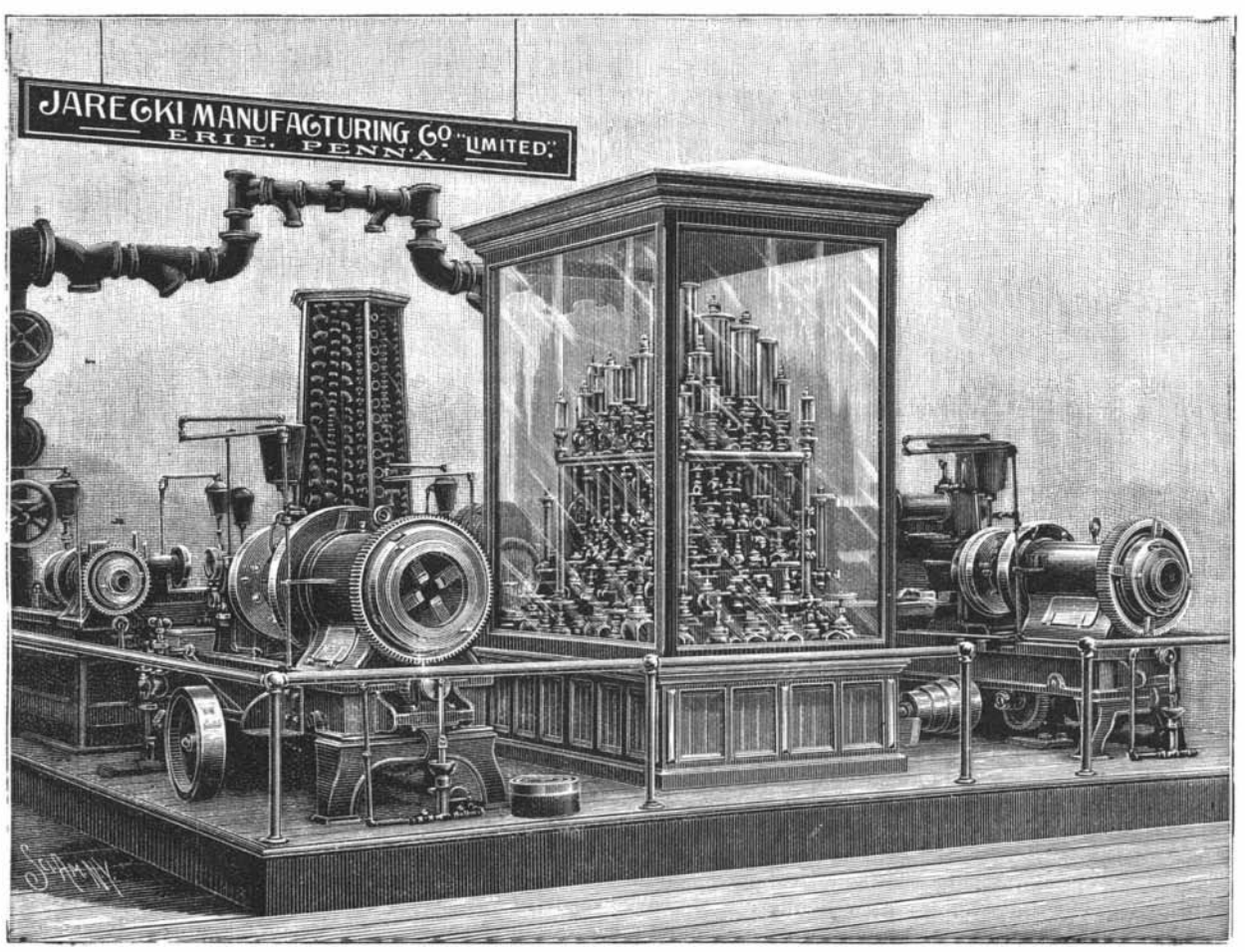
According to the New York *Tribune*, Prince Louis of Battenberg has invented a signaling apparatus, which is now on trial in the Royal Sovereign, and has received notices of approbation from various competent naval judges. The contrivance consists of a sort of collapsible spheroid, capable of being opened and shut like an umbrella, visible at sea for a far greater distance than flags, by which Morse code signals can be made without difficulty. If Admiral Fairfax and the signaling department report favorably, it will probably be adopted, to the satisfaction of the inventor, who is said to have been helped by Captain Percy Scott, now employed on signal books at the Admiralty.

The Ark Beats All.

Speaking of ancient ships and shipbuilding, Prof. J. Harvey Biles said that, though Great Britain and America had made such great strides in shipbuilding, none of their wooden ships approached the dimensions of the Ark, which was 450 feet long, 75 feet broad, and 45 feet deep. He calculated that this was the size of this vessel from the Bible measurements, taking the cubit to be 18 inches. This, he thought, was the correct measurement. The largest wooden ship afloat now did not nearly approach the size of the Ark; the vessel was the Shenandoah, and her dimensions were 299 feet by 49 feet broad and 29 feet deep. Even the Campania was much smaller than the Ark, except in length, and the dimensions of the Ark had only been exceeded in the case of the Great Eastern. In 1856 a prize was offered for the best model of a ship made by any one in the United Kingdom, and the models were on view at the Royal Institution. The prize was awarded to a model six times the beam to the length, and ten times the depth to the length, these being the same proportions as those of the Ark.

The Waterbury Watch Company.

Those who remember the description of the wonderfully curious and ingenious century clock shown in the Waterbury pavilion, as described in the SCIENTIFIC AMERICAN of July 1, will be interested to know that the Waterbury Watch Company received a medal at the Columbian Exposition for their exhibit. The clock not only represented, through finely carved miniature figures, all the details of watchmaking, but it showed miners at work digging rock, illustrated the development of the sewing machine, the telegraph, the telephone, the dynamo, the preparation of cotton and flax, and numerous other highly interesting mechanical and historical subjects. The company's exhibit also included about five thousand watches, all of the quick-winding model, the old long-wind watch having been discontinued five or six years ago. As the rules governing awards declare that there will be but one class of medals, this award is equivalent to the highest class medal of other exhibitions. A diploma was also awarded the company for artistic display, for general exhibit, and for the remarkable and now famous century clock.



WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF JARECKI MANUFACTURING COMPANY.

How to Obscure the Taste.

It is said that the active principle of Gymnema sylvestris, gymnemic acid, $C_{32}H_{55}O_{12}$, is very efficient, and it is suggested that before administering bitter remedies, the mouth be rinsed with a 12 per cent solution of this acid in alcohol and water. Gymnemic acid is a grayish-white powder, of sharp acid taste, very soluble in alcohol, but only slightly so in water and ether, and when the tongue is touched with it, the taste is completely lost for sweet and bitter, though acids, salty, astringent, or spicy substances are readily recognized.

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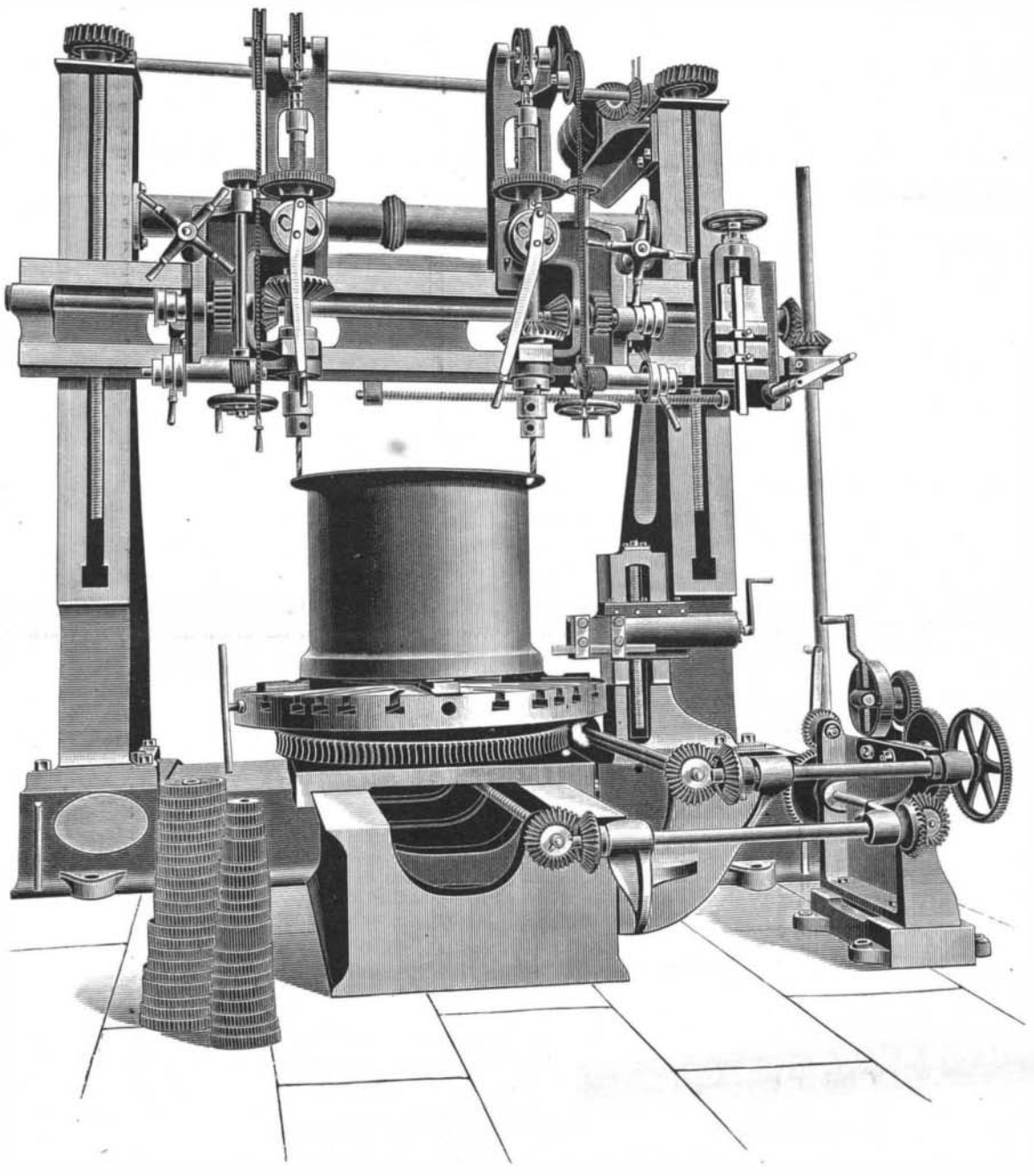
BOILER-END TURNING, BORING, AND DRILLING MACHINE.

The illustration represents a special tool constructed by Rushworth & Company, Sowerby Bridge, England, for turning, boring, and drilling. The machine will admit a job 8 feet 2 inches in height, while the height from the top of chuck to the under side of the spindles when the cross slide is in the top position is 6 feet 4 inches. The main bed and the two uprights or standards are very strong and massive, being of box section, with box bars, etc. The cross slide is arranged to rise and fall by worm gearing worked from belt-driven pulleys at the top of the right hand standard in the illustration. On this cross slide are two heads for drilling, arranged to rise and fall by power by worm gear, as shown on the illustration, to move by rack and pinion and by hand wheel, etc. The spindles are of steel, 3 inches diameter and 10 inches range, and are perfectly balanced, so that when the nuts, which are of gun metal, in two parts, are released by the lever in front, the spindles return quickly. The minimum distance from center to center of holes which can be bored is 10½ inches. The drills can be run separately or together, a steel clutch being arranged on each head carrying the drills, and worked by levers, as shown. On the same cross slide is arranged a tool box or turning rest for turning the edge of the flanged flue or the top. There is also a turning rest at the bottom, so that the top and bottom can be turned at the same time. The chuck which grips the flues is 5 feet in diameter, with five jaws, all connected with steel bevel wheels, so that the flue ring always remains concentric. The largest diameter the jaws will grip is 4 feet 9 inches, the smallest 2 feet. On the under side of this chuck is a worm wheel for driving the chuck for turning, and for dividing or pitching out the holes from 20 to 140 by the dividing arrangement shown on the side. The dividing handle, the handle for moving the chuck longitudinally, and the handle for the turning rest are close together, so that the workman has not to move. The strong slide which carries the chuck is arranged to move through the uprights by a screw having a range of 6 feet, 3 feet on each side of drills, so that tube holes in the portable boiler fire boxes can be bored in any part.

The miter and bevel gear are all of steel. The driving mechanism is all at the back on the right hand side of the machine, out of the way of the working. The weight is 17 tons. For the above and for our engraving we are indebted to *Engineering*.



IMPROVED MACHINE FOR BORING, TURNING, AND DRILLING.

Surgery in China.

In the *China Medical Missionary Journal*, published in Shanghai, Dr. J. C. Thomson has a very interesting article on surgery in China. Referring to the great fortitude of the Chinaman under surgical operations, Dr. Thomson says that even now it is frequently put to the test in circumstances where surgeons in isolated situations are compelled to undertake operations unaided, or where otherwise the employment of chloroform is contraindicated, and in the minor operations of surgery. When so tested the Chinaman will endure without flinching a degree of pain that to the more highly-developed nervous system of the westerner would be well-nigh impossible. His experience also goes to confirm the general testimony regarding the remarkable recuperative power of the Chinese after surgical injuries. The reasons he suggests are the simpler feeding habits of the Chinese, the rare occurrence of albuminuria or glycosuria, and their equable mental constitution. With reference to the Chinese surgeons who have already been trained by the medical missionaries, Dr. Thomson says his observation of these men leads him to the conviction that the Chinese are fitted to take at least a respectable place as surgeons, and that a time is coming when Chinese surgery will give favorable results.

Erratic Blocks.

In a recent number of the *Fortnightly*, Dr. Alfred R. Wallace, writing on the ice age and its works, says: "The enormous block near St. Petersburg, and the mass of Swedish red granite found at Furstenwalde, southeast of Berlin, are given as instances of erratic blocks. The erratic blocks from the higher Alps, which are found on the flanks of the Jura Mountains, are also shown to point conclusively to the former existence of glaciers stretching down the Rhone Valley as far as the Jura. The distribution of erratics in North America is next considered, and the crowning example of bowlder transportation is said to be afforded by 'the blocks of light gray gneiss discovered by Prof. Hitchcock on the summit of Mount Washington, over 6,000 feet above sea level, and identified with Bethlehem gneiss, whose nearest outcrop is at Jefferson, several miles to the northwest, and 3,000 or 4,000 feet lower than Mount Washington.'" After giving instances in Great Britain and Scandinavia of bowlders carried above their source, Dr. Wallace says: "We thus find clear and absolute demonstration of glacier ice moving up hill and dragging with it rocks from lower levels to elevations varying from 200 to 2,700 feet above their origin. In Switzerland we have proof of the same general fact in the terminal moraine of the northern branch of the Rhone glacier being about 200 feet higher than the Lake of Geneva, with very much higher intervening ground. As it is universally admitted that the glacier of the Rhone did extend to beyond Soleure, all the *a priori* objections to the various cases of rocks carried much higher than their origin, in America, the British Isles, and Scandinavia, fall to the ground. We must either deny the existence of the ice sheet in the great Swiss valley, and find some other means of accounting for the traveled blocks on the Jura between Geneva and Soleure, or admit that the lower strata of a great glacier *can* travel up hill and over hill and valley, and that the ice sheets of the British Isles, of Scandinavia and of North America merely exhibit the very same characteristics as those of Switzerland, but sometimes on a larger scale. We may not yet be able to explain fully how it thus moves, or what slope of the upper surface is required in order that the bottom of the ice may move up a given ascent, but the fact of such motion cannot any longer be denied."

American Pineapples.

According to a recent article in the *Youth's Companion*, a group of five small keys lying off the extreme southern point of Florida is now the principal pineapple producing district of the world. Less than seven hundred acres altogether are here devoted to the cultivation of this fruit, but from this area 4,500,000 pineapples have been shipped to New York in a single year. The plant is propagated from suckers or slips, and 10,000 may be planted to the acre, two-thirds of which will bear fruit, so that if a dollar a dozen could be realized, the crop would be a lucrative one. The most common variety is the Scarlet or Spanish, the one ordinarily seen in the North, on account of its good shipping qualities. Next in abundance is the Sugar-loaf, a sweeter fruit, but more delicate, and, therefore, more difficult to handle. Egyptian Queen, a large juicy fruit, is harder still to transport, and best of all is the Puerto Rico, a fruit weighing ten pounds, but so mellow that it is rarely seen more than two hundred miles from the place where it is grown. A field of pineapples, raised from slips, will bear for five years, though after the second year the yield steadily decreases. A field planted with suckers only yields for two years. After this the land seems exhausted, and its strength must be renewed with fertilizers, and by growing other crops, while plantations of pineapples are made in another field. The fruit which is allowed to ripen in the field is altogether superior in melting quality, rich flavor and wholesomeness to the hard, sour and indigestible specimens which must be picked while they are solid and green, so that they can endure a journey to Northern cities.

An Electrical Fog Signal.

An electrical method of fog signaling has been invented by an electrician in the employ of the Great Northern Railway Company. A wire is laid by means of a pipe from the signal box to the various signals, at which points brushes composed of copper wire project some four or five inches above the side of the rail nearest the signal. To the foot plate of the engine a similar brush is fixed, connecting with an indicator and bell on the engine. If the signal be at danger, the two brushes coming in contact has the effect of ringing the bell, and indicating to the driver by means of a miniature signal fixed on his engine that the line is not clear. The arrangement can be switched off in fine weather. The process, which is in working order at Wood Green, has proved so satisfactory that the company have decided to fit up the suburban lines, and eventually the whole of their system.

The Largest Bange Light in the World.

The Lighthouse Board will shortly begin the construction of the largest range light in the world on the present site of the Waackaack Beacon, just east of Sandy Hook. The lens, which was on exhibition at the Columbian Exposition, is six feet high and three feet in diameter. The lens cost $12,000, and is of the best French make. When placed on exhibition a small light was put behind it, but the rays were so powerful that it had to be removed and shown without a light. The light from the new beacon will be equal to that of a search light. The light is a very important one, as it is used by mariners entering the main ship channel after rounding Sandy Hook bound in.

Chloralamid.

In an address by Prof. Penzoldt, of Erlangen, delivered before the German Scientists' Congress at Nuremberg recently, on "The Influence of Drugs on Digestion," the speaker stated that "chloralamid was one of the few narcotic drugs which accelerated digestion, and in a pronounced degree."

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Professor Lanier's Process of Photographing upon the Wood Block.

This excellent process was described in its earlier form in *Photographic Work* for June 17 of 1892, but since then Professor Lanier has considerably improved the method, and he has instructed many operators, so that the method is in use by several of the large wood engraving establishments of the Continent. He publishes details in the *Correspondenz*, and says that instead of the zinc white previously recommended, he has made experiments with white lead and barytes white (sulphate of barium), but for most uses he still prefers the zinc white, especially if the firm and solid kind can be obtained. It must be admitted that white lead is better than zinc white in the matter of covering power, but such emulsions as are prepared to contain it are less sensitive than those made with the zinc, this being, perhaps, an indication that the white lead reacts with the nitrate of silver. Barytes white, on the other hand, though of less covering power than the lead compound, has no reaction with the silver compounds. Excellent results are obtained with the following formula:

A.	Gelatine solution, 1 to 20	5 cubic cents.
	Barytes white	6 grammes.
	Chloride of ammonium solution, 1 to 10	1·5 cubic cents.
B.	Citric acid solution, 1 to 2	3 cubic cents.
	Alcohol	2 " "
	Nitrate of silver solution, 1 to 5	6 to 8 " "

The two solutions are mixed in a small mortar, B being added drop by drop. Another preparation containing albumen and zinc white, and one which adheres well to the block, is made up as follows:

Four stock solutions are made thus:

A.—Gelatine, 1 gramme in warm water	30 cubic cents.
B.—Chloride of ammonium, 10 grammes in water	100 c. c.
C.—Nitrate of silver, 10 grammes in water	50 grammes.
D.—Citric acid, 10 grammes in water	20 c. c.

The following are ground together in a mortar:

Zinc white	6 grammes.
B	1·5 cubic cents.
A	2 " "
Albumen	4 " "

We now mix in a test tube:

C	7 to 8 cubic cents.
D	3 " "

This argentic solution is added drop by drop to the contents of the mortar, the whole being well mixed during each addition. The wood block is now coated with a thin rubber solution made by dissolving:

India rubber	3 grammes.
In chloroform	100 cubic cents.

This requires dilution with several times its volume of benzole before use. The rubber film being dry, and the edges of the block rubbed with fat to prevent the absorption of water, all is ready for the application of the sensitive coating, which operation must be done in a dully lighted place. A hog hair brush is used to apply the emulsion in the first place, when it is spread with a flat camel's hair brush (or the cheap substitute commonly sold), after which the coating—which should be but thin—is smoothed with a badger softening brush. The coating soon dries, and the blocks may be kept for several days. The printing may occupy from seven to thirty minutes. After exposure, a solution of chloride of sodium is flowed over the film to convert the silver nitrate into chloride. To fix, the exposed surface is turned downward in a flat dish containing a little hyposulphite of soda, the block being rested on small pieces of glass—about five minutes being required. In the same way (by turning down) it is immersed in a saturated solution of chrome alum, and then washed in several waters. When dry, it may once more be flowed with the dilute rubber solution. For line subjects an emulsion less rich in silver is to be preferred.

Macassar Oil.

BY ROBERT GLENK.

The true macassar oil, prepared from the seeds of Schleichera Trijuga, *Willd.*, one of the East Indian Sapindaceæ, has a great reputation in its native country as a stimulating application to promote the growth of the hair and also as a remedy in skin diseases, especially eczema.

It is obtained either by expression or by boiling the bruised seeds in water and skimming off the oil which rises to the surface.

It has in former years been imported into this country; latterly, however, a product under the name of macassar oil, but which in reality was mainly composed of cocoanut oil in which the blossoms of Ylang Ylang, Canaga odorata, or of the false Ylang Ylang, Michelia champaca, N. O. Magnoliaceæ, have been digested, began to make its appearance on the market and took the place of the former. Now, mostly domestic oils under the same name, suitably perfumed and frequently colored red with alkanet, have entirely replaced the natural product.

The writer recently received a small sample of the true macassar oil from Mirzapoor, Hindostan. At the ordinary temperature it is semi-solid, of a yellowish-white appearance, and has a weak odor of bitter almonds. It is said to contain hydrocyanic acid, and it is not unlikely that in the stimulating properties of this constituent the cause of the ascribed beneficial action of the oil may reside.

It has a mildly acrid taste, probably due to partial rancidity, and an acid reaction to litmus paper. It is completely liquefied at 82° F. (28° C.) and congeals near 50° F. (10° C.). The oil is readily saponified by sodium hydrate even at a low temperature, the soap being white and hard. With nitrous acid it assumes an orange-red color and becomes viscid, but does not seem to solidify. On adding 5 drops of the oil to 20 drops of concentrated sulphuric acid, it acquires a reddish-brown color. The oil is freely soluble in chloroform, ether, bisulphide of carbon, benzol, benzine, and the fixed and volatile oils, but only slightly soluble in alcohol. It has a specific gravity of 0·942.

An excellent formula for preparing a so-called macassar oil for the hair, and which has given great satisfaction to those who have used it, is the following:

Castor oil	16 f. oz.
Alcohol	3 f. oz.
Oil of nutmeg	30 m.
Oil of rosemary	10 m.
Oil of sweet marjoram	10 m.
Oil of neroli	10 m.
Oil of rose	20 m.
Tincture of musk	1 f. 3
Alkanet	sufficient to color.

—*Amer. Jour. of Pharmacy.*

Petroleum as Fuel.

On the Great Eastern Railway this fuel has been used in many of the engines for a considerable time, and the present extraordinary high price of coal is, we understand, leading to a considerable extension of the system. We note also that experiments in this direction are being made in some of the Lancashire cotton mills, on account of the difficulty of securing solid fuel, and hence a few words on the subject at the present juncture may not be out of place.

The question as to whether it is more economical to burn petroleum than coal turns entirely on the relative cost of the two fuels, coupled with the comparison of their respective evaporative values. For the purpose of firing steam boilers the use of the higher qualities of petroleum, such as that used for illuminating purposes, is altogether out of the question on the score of price, as the process of rectification to which the crude petroleum is subject very much enhances the cost. It should, therefore, be understood that in speaking of petroleum as a fuel it is really the residual or waste products from the mineral oil industry, as well as liquid hydrocarbons recovered from coal-fed blast furnaces, coke ovens, and gas producers known as blast furnace oil, creosote, and common tar oils, that are referred to. One of the simplest methods of burning these refuse oils in steam boilers is that adopted by Messrs. Nobel at their well known oil works at Baku. It consists of a series of shallow trough burners, arranged in a series one above the other, thus exposing a large surface. As the oil trickles down it flows from one stage to the other, and is thus vaporized and completely consumed by the time it reaches the lower tier of troughs. With this system of trough burners, it is stated, a practical evaporation of 14½ pounds of water per pound of petroleum refuse has been obtained, as compared with an evaporation of 7 to 8 pounds of water per pound of coal under similar conditions. The more common and practical method of burning these oils, however, is to spray them into the furnace tube or combustion chamber with a jet of superheated steam by an injector, which draws in the air supply at the same time.* The oil is thus heated and broken up into fine spray and thoroughly vaporized in the furnace, where it is also mixed with the air which supplies the oxygen for combustion. It is essential for the complete combustion of this class of fuel that the furnace tube should be lined, to some extent, with fire clay or brickwork, to act as an accumulator of heat and maintain a constantly higher temperature, and to this end the fire bars are usually covered with a layer of fire brick and fuel kept in a state of incandescence. In connection with the spraying of petroleum it may be stated that experience has shown superheated steam to be much more efficient than wet steam. The point is one which is sometimes overlooked. The most extensive adoption of the use of petroleum in this country has been on the Great Eastern Railway, where, as we have already stated, it has been in operation for some considerable time. The fuel generally used in these locomotive boilers consists of a mixture of two parts of coal tar with one of green oil, just to thin it down. The cost of this mixture twelve months ago was given as about 25s. ($5.50) per ton; what the precise price is at this moment we cannot say, as quotations have been somewhat disturbed by the present state of the coal market. If we credit the evaporative duty of the liquid fuel referred to as being equivalent to double that of coal—which, we may remark, is an outside estimate—then a steam user cannot afford to use it so long as the price of coal is less than half that of the liquid fuel. This is a basis of comparison that is invariable, and which any steam user can apply for himself, to meet the circumstances of his own particular case.—*The Practical Engineer.*

*For illustrations of petroleum spray injectors as used at the Columbian Exposition, see SCIENTIFIC AMERICAN of July 8, 1893.

Action of Light upon Dyed Colors.

The committee of the British Association of which Professor Hummel is secretary has undertaken a very laborious and tedious task, to determine by experiment the relative fastness to light of patterns of silk, cotton, and wool, dyed with 2 per cent of the artificial commercial coloring matters, and to the same depth with natural coloring matters. They were exposed in the country at Adel, five miles north of Leeds, in Mr. James A. Hirst's garden, the patterns being pinned on deal boards, covered with white calico, and fixed vertically in glazed wooden cases, the air, after being filtered through cotton wool, circulating freely. Every pattern was divided into six pieces. One of these was protected, the others exposed for different periods. The shortest "fading" period was about three weeks, May and June, 1892; at the end of the first period the standards were removed and new standards again exposed with the piece until fading to the same extent had resulted. The fourth and fifth series were exposed for a length of two or three fading periods, so that the fifth set might have an exposure of one year. This method was adopted in order to be able to expose in different years, as it is impossible to deal with a whole set simultaneously. The eosins and allied colors are the most fugitive; the methoxy group increases the fastness of the paler tint surviving after a few weeks. All basic reds, including magentas, are fugitive; the azo reds, and, more still, the secondary diazo compounds, are fast. Madder, cochineal, kermes, alizarin, and some chromotropes, 2 R and 2 B, belong to the exceedingly limited number of very fast reds; the Congo reds have not been tried yet.

Stereoscopic Photographs.

There is no limit to the vertical dimensions to which a stereoscopic pair of prints may be trimmed, should the subject demand it, such subject being a tall building, ravine, or other object of like nature. But, as regards lateral dimensions, the case is altogether different, and it is in this respect where so many blunders are made.

We take it for granted that every photographer at least desires that his friends shall be able to see and examine his binocular efforts without trouble or pain—nay, more, that they shall do so with such readiness as to be insensible of putting forth any effort in doing so; and the object of this brief article is to urge in bringing about such a state of matters, more especially as this is so easy of attainment.

The condition requisite for the average human eyes seeing the stereoscopic effect of a picture, and without any straining of the muscles of the eyes, is merely to see that the distance of an object *in the foreground* of one picture from the same object in the duplicate does not exceed three inches. It would still be better were this distance an eighth to a quarter of an inch less.

To those who possess slides of valuable or interesting subjects, whether portraits or landscapes, which resist their efforts in bringing them into coalescence, we would say steep them in tepid water, so as to loosen them from their mounts, and retrim them to the extent of taking a quarter of an inch, or thereabout, from the sides, finally remounting them.—*Br. Jour.*

Soluble Gold.

In the *Naturforscherversammlung* at Nuremberg, Dr. Schottlander described a curious colloidal form of gold, which was completely soluble in water with basic acetate of cerium. The solutions are a strong violet-red color, but when diluted, carmine-red. The intensity of the color is so great that a solution containing 1-500,000th of gold is still distinctly rose-red. Such solutions are obtained by precipitation of a dilute solution of a cerous salt mixed with gold by means of potash or soda lye and solution of the black precipitate formed in hot dilute acetic acid, or by boiling mixed solutions of cerous acetate, gold chloride, sodium hydrate in the proper proportions. From the red solution sodium acetate precipitates a violet-red precipitate which contains all the gold and some of the basic cerous acetate. On drying the precipitate, an amorphous, bronze-colored, glittering mass is obtained, which is soluble in water. This is somewhat akin to Carey Lea's soluble silver.—*Photo. Mittheil.; Am. Photographer.*

A FLAT car costs about $380, a flat bottom coal car $475, a gondola drop bottom $500, a double hopper bottom coal car $525, a double hopper bottom coke car $540, a box car $600, a stock car $550, a fruit car (ventilated) $700, and a refrigerator car $800. A four-wheeled caboose costs $550 and an eight-wheeled one $700. The prices given on the above cars include power brakes and vertical plane couplers. A 50 foot mail and baggage car costs $3,500, a second class coach $4,800, a first class coach $5,500, while a first class Pullman car costs $15,000.

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DISPLAY OF FIREWORKS AT THE COLUMBIAN EXPOSITION.

Soon after the World's Columbian Exposition opened the management discussed ways and means for attracting the largest number of visitors, and among other attractions provided were electric illuminations and fireworks on specified evenings. The fireworks were regarded as an uncertain experiment, but they proved to be very popular from the outset and soon became profitable attractions, and were accordingly given greater prominence. The first displays were held around the basin, but later a platform was constructed out in the lake east of the Manufactures and Liberal Arts building, and from about the first of July until the close of the Fair the fireworks were given on the lake shore.

Who will not recall vividly just such a scene on one of the special evenings as is depicted in the center of our first page illustration? Stretching along the half-mile expanse of the lake shore between the war vessel State of Illinois and Music Hall was a great open area which was densely packed with people almost every evening. From the roof of the Manufactures and Liberal Arts building powerful electric search lights flashed their great beams of light across the heavens. One of the most memorable of these occasions was on the evening of the Fourth of July. The hour for the display to begin had passed when the two hundred thousand or more people who were anxiously waiting heard a shout at the north end of the Manufactures and Liberal Arts building. There was a buzz of excitement as a powerful search light revealed a balloon sailing out over the lake with what appeared to be a lantern suspended from it. Just as the balloon reached a height immediately over the heads of the crowd there was a flash of light, a shower of sparks and the American flag was revealed in brilliant flame suspended in midair.

The balloon which supported the flag was sixty feet high and nearly thirty feet across, made entirely of cloth. It was inflated with hot air, several hours being required to complete the operation. The flag was composed of a multiplication of strings or chains which were carefully rolled up on a framework and which were set free by a slow-burning match. Each chain was one hundred yards long and the flag or multiplication of chains was sixty yards wide—a size far beyond what it was popularly supposed to be. The hanging chains and festoons at the left of the illustration tell in a small way of the structure of the flag.

The question, What makes the chains remain suspended in the air and why do they float away so gracefully? might have remained unanswered had not the search lights revealed to close observers a parachute from which each chain was suspended, while the festoons had a parachute at each end. These chains were produced by what looked like ordinary rockets. The longest chains were one hundred and fifty yards long.

Fig. 4 shows a sectional view of an ordinary rocket. There is a vast difference in the size of these rockets, the smallest being of one ounce size, while the largest is six pounds. This large size requires a stick six feet six inches long and one inch square to guide it in its flight. In ordinary rockets the stars are independent of each other, and when the cylinder bursts during the downward flight they fly in every direction. In the hanging chain and festoon rockets the stars are attached to a string, but in such a way as to be at right angles to it, so that it is quite out of the question for the string to be burned before the stars have become dim, if not entirely extinguished. The parachutes to these rockets are sometimes made of silk, but usually of Japanese paper designed especially for the purpose. When the rocket explodes, the chain, which has been carefully rolled up so as not to become entangled, unrolls, and by its fall automatically opens the parachute.

Bombs or shells are probably the most popular and at the same time most expensive of fireworks usually used. Fig. 9 shows a series of small mortars and one of the largest size that was used at the Exposition to fire bombs. These bombs vary in size from a few inches to twenty inches in diameter, the largest ones costing $150 each. The cases are made of *papier-mache* in two parts, which fit so perfectly as to be gas proof. They are then covered with canvas, bound with heavy cords, then strengthened by another cover of canvas. They are filled with stars and a slow match placed at the top of each bomb. Underneath, and lightly attached to it, is a cone, which contains the powder to fire the bomb. Two fuses join at the top of the globe, as shown, to furnish the train with which to touch it off. This train is of considerable length, and is lighted by a match attached to the end of a long pole, in order that the attendant in charge may stand as far away as possible. Were these precautions not taken, he might be made deaf by the detonation of the explosion. By the use of the two fuses, the ignition of the powder becomes practically an absolute certainty. In the largest size of bombs there are from six to seven pounds of powder in the cone, and when it ignites, the bomb is projected into the air to a great height and at an enormous rate of speed, leaving the cone in the mortar.

The feature of these bombs is the shower of stars they scatter as they burst, and the beauty of the effect depends upon the success of the color effects produced. The mechanical part of making the stars is simple. In Fig. 8 a full size star is shown. This is what is called the "pill box" star, and is the one most used. The cone is a section of a pasteboard tube filled with the desired compound to produce a given color, and a piece of fuse is drawn through it, leaving both ends exposed, so that the probability of its igniting is doubled. The largest size of bomb, already described, will hold eighty pounds of these stars, somewhere between ten thousand and fifteen thousand in number, according to color and size, and, upon exploding, spread them out sufficiently to cover an area of about three acres. All the pyrotechnics at the Exposition were provided by Pain's Fireworks Company, 102 William Street, New York, and the brightness of the colors and the combinations of effects that were produced showed that this company excels in the quality of its work.

In the manufacture of fireworks extra-hazardous compounds are avoided as much as possible, for, at the best, the risk is great. Among the materials most used in producing colors are Paris green, when an arsenical compound is wanted; sodas of various kinds, charcoal, magnesium, strontia, baryta, calomel, saltpeter, chlorate of potash, antimony, steel and iron filings, and preparations of zinc.

Probably the most eccentric of all fireworks is the "water devil," shown in Fig. 10. Each piece consists of two distinct parts, the propelling power, which is represented by the cylinder, which is the foot, and the effect, which is the head. These two parts are set at an angle to each other, as shown, so as to propel the piece in a zigzag path.

The tourbillion is another interesting piece. (See figure.) It hisses like a rocket, and sends out showers of stars which assume the form of an umbrella. In the large size the stars fill an area from twenty to thirty feet in diameter. Fig. 11 shows floating jerbs. These comprise simple floating receptacles from which Roman candles, golden fountains, fiery geysers and other fireworks can be sent off, giving the effect of their shooting out of the water.

No great display of fireworks is complete without its "set piece," or, as it is technically termed, "lance work." Portraits, mottoes, pictures of buildings, in fact, almost anything that can be drawn on paper, can be reproduced in this way with surprisingly vivid effect, even to every desired color. An amount of preliminary work is required which seems all out of proportion to the time that the picture actually lasts, but the impression left in the mind is lasting.

The picture to be reproduced is sketched by an artist, on paper laid off in squares, corresponding with squares on the framework upon which the lance work is to be done. Let us take our front page, which shows a portrait of Director-General Davis. This framework was thirty-five feet high and thirty feet wide, and comprised twenty-one blocks, each ten feet long and five feet wide, laid off into squares one foot each way. The artist, with a piece of chalk fastened to the end of a long stick, sketched the outline of his picture on the framework corresponding to the sketch in his hand. An attendant followed behind him, nailing strips of bamboo over the chalk lines. The twenty-one individual frames were then sawed apart where these strips joined them together. A boy following the second man put wire nails at intervals of four inches in the framework, and another attendant placed the "lances" in place. When the lances were all set and glued in place, a quick match was pinned over the upper ends of the lances, connecting them all together as shown in Figs. 1 and 2. This pin penetrated a priming on the head of each lance, which ignites the instant fire is present. After all the lances are in position and the fuse is applied, the whole frame is elevated into its position. When the display took place the picture was touched off at three different points, giving an effect of every lance being lighted at the same instant. How nearly this was so can be judged from the fact that, were a man to take one hundred feet of quick match used for this purpose, hold both ends in his hands and light one end, the fire would reach the other end before he could drop it.

Gunpowder enters largely into the manufacture of fireworks to serve for ignition, but not for color effect. Several grades and qualities are used. One kind, called "meal powder," being manufactured especially for the purpose.

Probably no city in this country ever had such elaborate pyrotechnic displays as Chicago had in connection with the Exposition. At the dedicatory exercises October 20, 1892, displays were held in three parks which cost $25,000, and on several occasions during the time the Exposition was open displays were held which cost $10,000 each, such an evening being represented in our illustration.

THE first lighthouse in the United States was built on Little Brewster Island, Boston, 1715.

Correspondence.

How to Acquire Languages Rapidly.

To the Editor of the Scientific American:

I note article in issue of this date in regard to "How mail clerks assist the memory." I have to state that when quite a lad I had occasion to learn the "U. S. signal code,' 'which is familiarly known as "wig-wag," and they first used cards with the numbers on one side and letter, or phrase, equivalent on the other. Finding it of great convenience, I used the principle in the study of French and Spanish, putting on one side English and on the other the equivalent in French and Spanish, by that means enabling me to keep the languages separate, though studying them at the same time. I would sincerely advise any one who has a limited time at his disposal for acquiring a language to adopt this method. I was enabled to acquire such fluency that I had no more difficulty in *thinking* in the language I was speaking than in English (my mother tongue) in less than a year, and having only odd moments for study.

FRED. MOREE TAYLOR, M.D.

Sault Ste. Marie, Mich., November 11, 1893.

How to Become an Electrical Engineer.

To the Editor of the Scientific American:

Your note in the SCIENTIFIC AMERICAN for October 28 on "How to Become an Electrical Engineer" accords so completely with my own views upon the subject that, with your permission, I cannot refrain from expressing some of the ideas in mind.

An electrical engineer should, above all things, be thoroughly practical. There is no use for a man in this profession, whether he be superintendent or the one in charge of electrical machinery, who cannot tell how a thing should be done, and do it himself, if necessary, from having *learned* to do it with his own hands. We learn to do by doing; and a course of study for engineers that does not take account of this fact lacks the very vital element, so it seems to me. The student must have daily practice in the electrical laboratory, in the draughting room, in the shop, in the boiler and engine and dynamo rooms, if he expects to meet the difficulties of after experience triumphantly. This provision made, it becomes, of course, necessary that he pursue mathematics and the theory of electricity and of machines.

More clearly to illustrate the point in hand, permit me to draw from the actual work of the institution whose electrical department I happen to represent. The course in electrical engineering covers two years, and aims to include as much of the purely theoretical as every practical engineer should know. The student spends from four to six hours a week in the shop during the whole course. Here he learns skillfully to make parts of machinery and complete apparatus of various kinds, also small dynamos and motors. Mechanical drawing is continued through the course also. This is obviously as essential to the electrical engineer as the purely mechanical student. Practical laboratory work is carried out in exact measurements in electricity and magnetism, including primary battery testing, with such authors as Kempe, Stewart and Gee, Ayrton, and Gray as guides. Regular practice is given in the care and operation of steam boilers and engines, dynamos and motors; both arc and incandescent systems of lighting and of machinery are studied by practical experience in the use of them for two years. In this work each man on duty at boilers weighs his coal and measures the water evaporated during the night's run. This, with the indicated horse power of the engines as calculated by the man on duty there, enables him to estimate the water evaporated per pound of coal, and the amount of coal used per indicated horse power per hour. He further determines the cost in fuel and water of each lamp maintained during the run. The man at the dynamos and motors tests them for characteristics, efficiency and regulation. The lamps are also tested from time to time as it is found necessary. Thus each man learns to handle a plant efficiently and economically, which, after all, is the great end in running machinery.

Besides the practical work, the course includes the theory usually taught in electrical courses, with some work required outside the electrical course proper. These required branches are mathematics to trigonometry, with calculus and mechanics elective, physics and chemistry; these last are the regular junior courses in these subjects. It will not be necessary to outline the theoretical portion of the work, for it is not essentially different from the usual courses in engineering. But what we do lay stress upon is the practical portion. And in this regard we think we are carrying out the true theory.

A. A. ATKINSON.

Athens, O., November 11, 1893.

Solution Against Insect Bites.

The following formula is published by the *Jour. de Pharm. et de Chim.:* Ammonia water, 3 gm.; collodion, 1 gm.; and salicylic acid, 10 cgm. One drop to be applied to each spot affected.

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MANUFACTURE OF STEARIN CANDLES.

Candles are cylindrical rods of solid fatty or waxy matter inclosing a central fibrous wick, and designed for giving light. The raw materials mostly used for candles are tallow and palm oil. Ordinary tallow candles are made from the fat of sheep and oxen. It is taken as soon as possible from the carcass of the animal, sorted, cut to pieces and melted. Tallow consists of palmitic, stearic and oleic acids, with glycerine, a substance which is uninflammable. The melted tallow is run into large barrels or casks holding about 1,300 pounds and taken to the candle manufacturers, where they are rolled on a trough about 25 feet in length, 2 feet in width, and about 6 inches in depth. The cask is placed on the trough with the bung hole underneath. A steam pipe is then inserted into the hole, the steam turned on, causing the tallow to melt and run down into the trough, thence through the flooring to a large tub below. This tub is connected by means of a 4 inch pipe to what is called the "blow-up," which is 14 feet in length and 5 feet in diameter. The melted fat, to the amount of 7,000 pounds, is drawn from the tub and run into this apparatus. About 35 pounds of lime is then dissolved and added to the mass, which is then heated by steam until thoroughly mixed, forming a soapy mixture which separates the acids and the glycerine. It is then blown out by steam into a decomposer. This apparatus is made of copper, 32 feet in height and 4 feet in diameter. Steam at 100 pounds is then turned on and the acids allowed to boil. The water, which is always at the bottom of the mass of fat, is constantly drawn up by the aid of a steam pipe passing down through the center of the cylinder. The water, when it reaches the top, falls down on and through a perforated diaphragm containing about 300 small holes to the inch, where it immediately passes to the bottom. The heat and pumping operation continues for about 10 hours, which separates the glycerine from the acids. It is then tested. If the material when cooled becomes crystallized, it is ready for the next operation.

The dissolved glycerine and water is drawn off and the acids pass to another tub, where, by the means of sulphuric acid, the fatty acids are set free from the lime. Boiling water is then used to free the fatty acids from the sulphuric acid. The liquid then passes into large circular tubs called chargers. From the chargers the acids pass into a still, circular in shape and made of copper. It is 6 feet in height, about 7 feet in diameter, and holds about 5,000 pounds, under which a fire is kept constantly burning and a temperature of 550° given to the still. From the still it is then condensed and run down into pans to solidify. The cakes, which are about 12 x 20 inches in size and one inch thick, are then wrapped in camel's hair cloth and put into a hydraulic press, which, with a 6,000 pound pressure to the inch, squeezes out the oleic acid. The cakes are then remelted and ready to be formed into candles. Each moulding machine contains about 96 moulds.

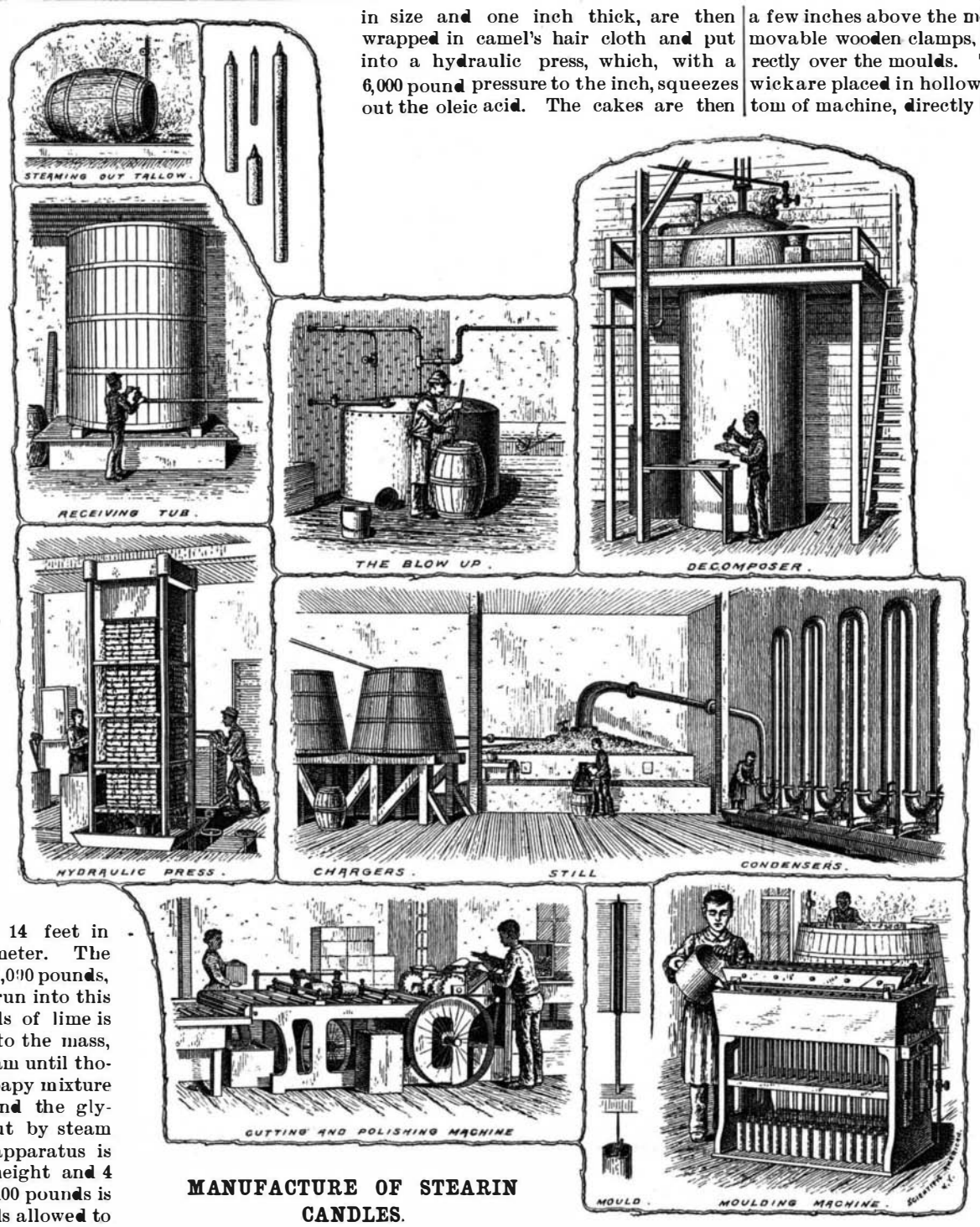
They are made of a composition of lead and zinc and rest in an iron bed, surrounded by water for cooling purposes. Underneath each mould is a hollow tin tube the upper end of which is conical shaped, and fits inside the lower end of mould. The bottom end rests on a movable platform. Connected to the machine a few inches above the mould beds are two perforated movable wooden clamps, the holes of which come directly over the moulds. The spools of cotton yarn or wick are placed in hollow circular tin boxes at the bottom of machine, directly underneath each tube. The wick is passed through the tubes and moulds and through the clamps above, where it hangs in the center to a piece of candle lying across the holes on the upper side of the clamps. When the moulds are ready to be filled the attendant pulls the wicks taut from the bottom, which causes them to hang directly in the center of the moulds. The melted material is poured in the beds at one end until the moulds are all filled. They are then allowed to cool about 15 minutes.

The movable platform containing the tubes is raised, which in turn shoves the candles upward out of the moulds and up into the clamps. The moulds are then refilled as before, and when cool, a knife is run along the top of the bed, cutting loose the first batch of candles, which are taken away and thrown into a tub of water to cool. The same operation is performed over and over again until 100 yards of wicking is run out.

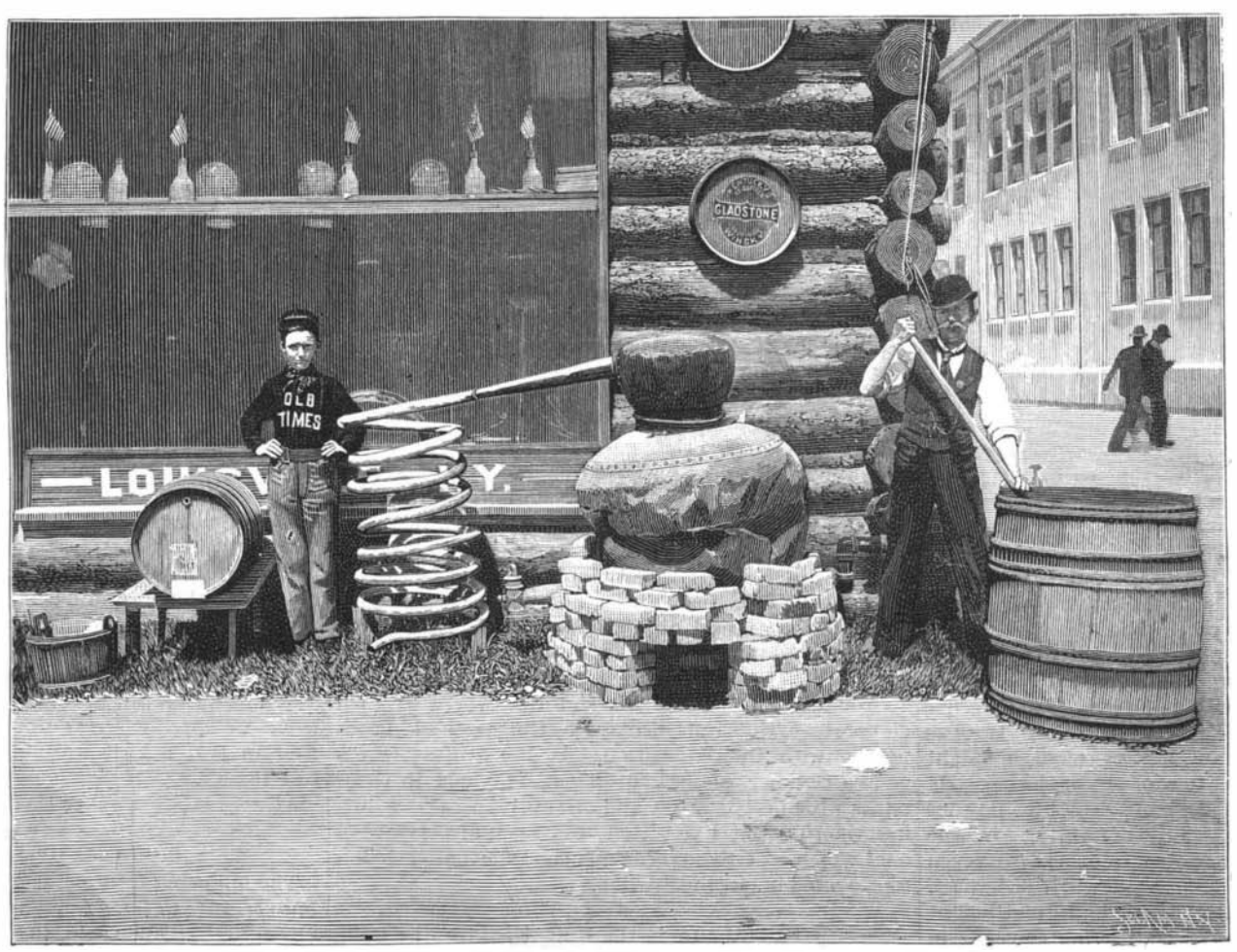
The candles, when taken out of the water, are passed through the cutting and polishing machine. The attendant places the candles on a slotted wheel, which carries them to a fine circular saw about 6 inches in diameter, with ½ inch teeth, which cuts them the right length. They are then carried along and dropped on to a movable bed to be polished. This bed consists of a number of circular iron bars or rods ¾ of an inch in diameter, 1½ inch apart, and connected to a chain on each side of the machine.

Connected to the machine and running across the movable rods are two circular revolving bristle brushes making about 120 revolutions per minute. The brushes are about a foot in length and about 8 inches in diameter. As the candles leave the saw they drop down in between each rod, which pushes them ahead, causing them to revolve. They are then drawn under the brushes, which gives them a polished appearance. They are then packed into boxes for shipping.

Candles in large quantities are shipped to South America and Mexico. They are also used by grocers, plumbers, and miners; 39 hands, with 40 moulding machines, can turn out about 8,000 candles per day. They run in size from about 5 inches to 24 inches in length. Our sketches were taken from the manufactory of A. Gross & Co., N. Y.



MANUFACTURE OF STEARIN CANDLES.



THE COLUMBIAN EXPOSITION—A "MOONSHINER'S" PLANT.

THE COLUMBIAN EXPOSITION—A "MOONSHINER'S" PLANT.

In a corner of the grounds of the Columbian Exposition, in the part called the "back yard," stood one of the most cu-

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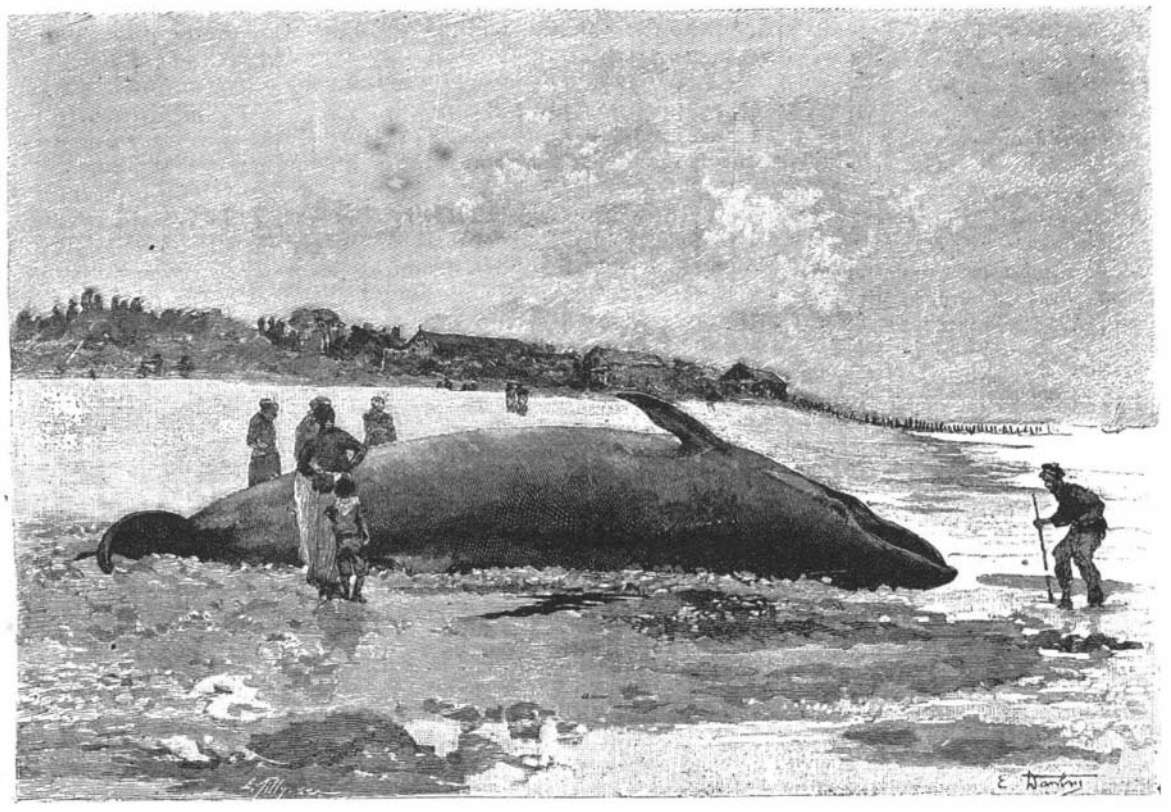
rious exhibits at the Fair—the plant of an illicit distillery. We illustrate the battered still and worm which was exhibited by the Old Times Distillery Company, and which is claimed to be the only distilling plant brought away from the mountains. The plant of an illicit distiller, or in cant phrase "moonshiner," is very seldom preserved when captured. Either the still is destroyed before the seizure or it is destroyed by the revenue officers, as in many cases the distillery is located on the top of rugged mountains, which makes the transportation of the seized articles difficult.

There is very little of the romance of crime left in America. The gentle art of holding up a coach is now practically a thing of the past. So that there is little left in the way of exciting adventures, except the too frequent train robberies and the occasional disturbance of the half-nomadic people of Kentucky, Tennessee and some other States, who gain a precarious livelihood by the illegal distillation of ardent spirts. Though the literature in regard to moonshiners is very limited, two or three novelists have used the stills in the mountain fastnesses as a foundation around which to weave their plots.

There appear to be three distinct classes of people who engage in illicit distilling; first, the common criminals; second, old confederate soldiers; and third, the descendants of the men who engaged in the post-revolution whisky insurrection, men who regard revenue laws as unjust and oppressive. Rye is one of the principal cereal crops in many of the States in which illicit distilling is carried on. Rye is bulky, cheap, and therefore not convenient or profitable to transport over the wretched roads But once converted into whisky, it can easily be transported on horseback, and the commodity can be readily disposed of near home.

To men coming of a whisky-making, whisky-loving people, the laws of the federal government enforced by the Treasury Department seem tyranny. It is stated that whisky can be made where rye is cheap for twenty cents a gallon. The internal revenue tax is now ninety cents a gallon. So that it will be readily seen that large profits may be made if the whisky can be sold without having to pay the tax. When attacked, the moonshiners defend themselves, and as they are expert marksmen, the pursuit of the moonshiners is extremely hazardous; but they are not as bloodthirsty as they are usually painted, and it is a significant fact that most of the revenue officers who are murdered are shot in the back. As soon as a moonshine still is broken up in one place, another is started a few miles away. The border of North Carolina and Georgia is a very bad spot for illicit stills, the people traveling from one State to the other when necessary.

The still is in form nearly always of the crudest shape, like the one illustrated, which is really a very good example of a better class still. Some of the makeshifts resorted to by these curious people are really amusing, and many of the stills are made of common wash boilers. The grain is, of course, hand-mashed. The market is generally local, seldom being outside of the State. The moonshiner is a curious outgrowth of the revenue laws, and his history forms a very curious picture of the primitive condition of border life.



A STRANDED WHALE.

A WHALE STRANDED AT VILLERVILLE.

A whale that had strayed into the mouth of the Seine went ashore Saturday, October 21, upon the coast of Calvados, under the herbage of Criquebœuf, near Villerville, between Honfleur and Trouville. It was perceived at about six o'clock in the morning by some fishermen, who at first took it for a capsized boat, but were undeceived when they saw it spout water to a height of eight or ten feet. Having adventured too near the coast at a moment when the tide was falling very rapidly. it was caught on the beach, and, despite its efforts, was unable to regain the open sea. It struggled for seven hours, giving formidable blows with its tail from time to time. It ceased to live at one o'clock in the afternoon.

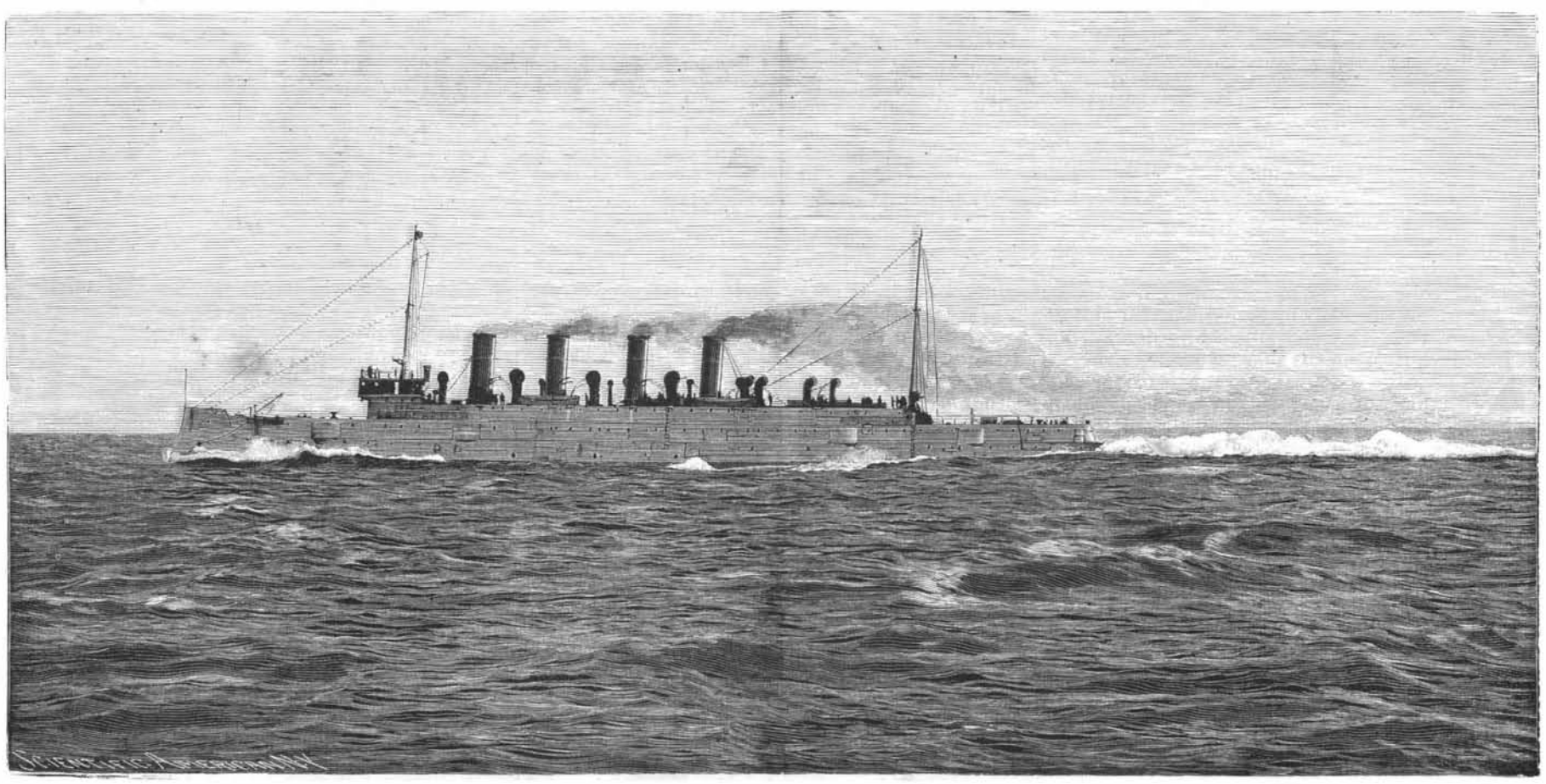
It was 10·5 meters in length. Its vertical diameter was 1·3 meter and its horizontal diameter was 1·75. Its jaw was 1·15 in width. Its flippers were 1·2 meters in length and the fin on the back 0·75 meter. The width of the tail was 1·3 meters.—*L'Illustration.*

OUR PHOTOGRAPH OF THE COLUMBIA.

We give this week an engraving of the new war ship Columbia, taken when the ship was running at highest speed on her recent official trial. It will be noticed there is an absence of undue wave. The three propellers at the stern throw up the water considerably, and form a rather wide cataract ten feet high, which subsides gradually, and no heavy waves are formed. The bow waves are comparatively light, and in this respect are in strong contrast to some other war ships. The Columbia is one of those poetic vessels that seem to "walk the water like a thing of life."

The Columbia is 412 feet long on the load water line, 58 feet extreme beam, 22 feet 6½ inches normal draught, and displaces 7,350 tons. Her power consists of three three-cylinder vertical inverted triple expansion engines, having about 22,000 collective indicated horse power and driving three screws, one on the middle line, as in single screw ships, and the other two under the counters, as in twin screw vessels. This power is calculated to produce a speed of 21 knots an hour, which the contract for the vessel calls for, the builders to receive a bonus of $50,000 for every quarter knot the vessel makes over the required twenty-one knots. On the official trial she made a mean speed of 22·81 knots, thus netting for the fortunate builders, Messrs. Cramp & Company, the handsome bonus of $350,000 above the contract price.

Notwithstanding the above successes, it cannot be said the speed of the Columbia is commensurate with her great power. We believe she is the highest engined boat of any ship afloat of her size, but not the fleetest. Her displacement is 7,350 tons, with 22,000 horse power, or 3 horse power per ton of displacement. The two new Cunard ships, built to serve as war cruisers, are of 12,500 tons displacement, 30,000 horse power, twin screws, showing $2\frac{2}{5}$ horse power per ton of displacement. These boats have made the Atlantic voyage of nearly 3,000 miles at an average of 21·3 knots per hour. It would doubtless be impossible for the Columbia to make such a voyage at that rate. Smaller ships, with higher engine power in proportion to dis-



From a photograph by W. H. Rau.

THE NEW WAR SHIP COLUMBIA.

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placement than the Columbia, have been built. For example, the Japanese cruiser Yoshino has a displacement of 4,000 tons, horse power 15,000, or 3·75 horse power per ton. Her mean speed on the official trial was 23·031 knots.

The Columbia is, however, a splendid ship, highly creditable to the country, and unsurpassed by any other vessel of her size. Our navy department having done so well in the production of this vessel, we hope will continue its good works until we can really boast the possessionof a vessel that can run as far and as fast, or faster, than any of our Atlantic liners. Not till then can we really claim to own a "commerce catcher and destroyer."

Railway Accidents.

According to the Fifth Statistical Report of the Inter-State Commerce Commission, the number of railway employes killed during the year ending June 30, 1892, was 2,554, the number of employes injured being 28,267. The number of passengers killed was 376 in 1892, as against 293 in 1891; while the number of passengers injured was 3,227 in 1892, as against 2,972 in 1891. An assignment of casualties to the opportunity offered for accidents in 1892 shows 1 employe to have been killed for every 322 employes, and 1 employe to have been injured for each 29 men in the employ of the railways. A similar comparison shows 1 passenger killed for each 1,491,910 passengers carried or for each 35,542,282 passenger miles, and 1 passenger injured for each 173,833 passengers carried or each 4,140,966 passenger miles. The largest number of casualties to employes resulted from coupling and uncoupling cars, 378 employes having been killed and 10,319 injured while rendering this service. Of the total number killed in coupling and uncoupling cars, 253, and of the total number injured, 7,766 were trainmen. The accidents classed as "falling from cars" were in this year, as in previous years, responsible for the largest number of deaths among employes, the number killed in this manner being 611. Of this number 485 were trainmen. Collisions and derailments were responsible for the death of 431 employes. Of this number 336 were trainmen. This class of accidents is responsible also for the largest number of casualties to passengers. Thus 177 passengers were killed and 1,539 were injured by collisions and derailments during the year. Collisions alone were responsible for the death of 286 employes and 136 passengers.

The True Physician.

The money-making idea is one that is dominant in the majority of humanity, and every occupation is looked upon as a trade. Philanthropic motives, pure and simple, are either sneered at as visionary, uncharitably branded as a trick of trade, or considered as a mere advertising dodge. True medicine, however, proclaims that the true physician is most happy when the patients are most healthy; this idea the common mind rejects as an absurd and impracticable doctrine. There is a belief very generally spread that the physician has no interest in the preservation of health, but rather rejoices when there is the most sickness. This may be true in rare cases, but as a rule it is untrue. The physician who practices his profession for mere mercenary motives has certainly a very low character and a decidedly sordid spirit. Some one has most truthfully said that the sanitary engineering and preventive skill which make our homes sweet and comfortable tend to check disease and impoverish those who dare to bring down medical art to the level of a trade. No tradesman would get up in the middle of a cold winter's night, and ride ten miles without the prospect of pay, and yet the physician does this often. The true physician, therefore, becomes a teacher of benevolence.—*Med. Summary.*

Poisonous Gases.

Carbonic oxide is one of the most dangerous gases; it is disengaged especially by the combustion of coal. Leblanc found that the difficulty of breathing air impregnated with coal gas is due especially to the carbonic oxide thus generated, and not to carbonic acid, which is not generated in sufficient quantity to account for the poisonous quality of the air. A kilogramme of glowing coal will suffice to make the air in a space of 25 cubic meters unbreathable. An equally poisonous gas is sulphureted hydrogen. In the experiments of Dupuytren and Thenard $\frac{1}{1600}$ of this gas in the atmosphere proved fatal to a greenfinch, $\frac{1}{800}$ to a dog, and $\frac{1}{250}$ to a horse. Chauffier observed that both this gas and ammonia vapor proved fatal to animals in a few seconds. Chlorine gas cannot be inhaled, as the epiglottis closes spasmodically; even the smallest quantity mixed with the air provokes violent coughing. It kills animals quickly. Many poisons inhaled in gaseous form are equally as dangerous as if introduced into the blood in other ways. The noxiousness of the vapor of quicksilver is well known. Arsenious gas is one of the most dangerous poisons; and numerous deaths have occurred from the inhalation of cyanogen gas.—*Der Stein der Weisen.*

Does Farming Pay?

"Nine-tenths of our farms are mortgaged for all they are worth." This statement has been made so often that the general impression among all classes of people is that it represents the facts. Nothing could be further from the real truth. But not until the census of farms, homes and mortgages was taken in 1890 was it possible to get at the truth on this subject. These returns are now sufficiently compiled to warrant the following startling statements.

Three-quarters of all the farms in the United States are owned free of incumbrance. Only one-fourth of the total number of farms in the United States are mortgaged. Or, to express it more specifically, out of every hundred American farms, more than 70 are fully paid for and less than 30 are mortgaged.

The average mortgage represents only one-third the value of the farm upon which it is secured.

The total amount of farm mortgages in the whole country is hardly one-tenth the total value of all our farms.

In 1880, nearly one-fifth of the mortgage indebtedness rested on farms; but in 1890 farm mortgages represented only one-seventh of the country's total indebtedness on real estate.

Out of every hundred families on American farms in 1890, 47 owned their farms free of mortgage, 20 owned but with incumbrance and 32 hired the farms they lived on and worked.

Of those who cultivated their own farms, 70 per cent owned without incumbrance and only 30 per cent had mortgages. Of the farms occupied by tenants, less than 10 per cent were incumbered.

Four-fifths of the amount of debt on farms and homes was incurred for the commendable purpose of buying and improving the property, and a like proportion of the numbers of farms and homes were mortgaged for the same purpose.

The total real estate mortgage debt that existed in the United States in 1880 is estimated at 2½ billions of dollars, equally divided between lots and acre tracts. In 1890 the total amount of such incumbrance had more than doubled, but only 34 per cent of it was on acres and 66 per cent on urban property.

The total mortgages on actual farms were about 525 millions of dollars in 1880, and ten years later were about 875 millions, an increase of 350 millions of dollars in the decade.

During these ten years no less than 600,000 new farms were created at the West and South. If only one-half of them carried the average-size mortgage, this would readily account for the increase in the total debt on farms.

Mortgages on other acre tracts than farms proper were in 1890 about 1,163 millions of dollars, or an increase of 438 millions during the decade.

The mortgages on lots, that is, on city and town property, amounted to 1,250 millions of dollars at the opening of the ninth decade, but in 1890 were estimated at nearly 4,000 millions, or an increase of over 2,700 millions during the ten years.

The total mortgage indebtedness in June, 1890, is estimated to have been some 6,000 millions of dollars, as against 2,500 millions in 1880, an increase of 3,500 millions.

These figures look large, but show that the total indebtedness on all real estate in the United States is only about $92 per capita. Add to this the per capita amount represented by the public debts of the United States ($14.63), of States and Territories ($3.56), and of counties ($2.27), a total of $20.40, and it appears that the total public debt and all real estate mortgages in the United States amount to only $112 per capita.

In other words, in June, 1890, the sum of $112 from each man, woman and child in the United States would have paid all the mortgages in the country and also all the national, State and county debts. In France, the national debt alone exceeds $116 per capita, England's national debt is nearly $90 a head, while the public debts in the older Australian colonies are $300 for each inhabitant. There are good reasons for believing also that mortgages in England, France, Germany and Australia vastly exceed the American average of $92 per capita.

The official figures for 33 States, upon which the foregoing statements are based, were prepared for the *American Agriculturist* by George K. Holmes, special agent in charge of division of farms, homes and mortgages of the eleventh census, and are given in full in the December issue of that magazine, in connection with Mr. Myrick's article. Another interesting fact is that the number of families is practically one to a farm in most States, but for 22 States these farm families comprise 35 per cent of the total number of families. In this group of States only one-fourth of the farms were occupied by tenants in 1880, whereas now nearly one-third of the farm families are tenants—a gain in the wrong direction. The article concludes with the following statement:

"Certain it is that enough has been set forth herein—most of it for the first time—to demonstrate that the facts about farm mortgages have been grossly distorted and exaggerated. The indications now are that the final figures will show that over two-thirds of our four and a half millions of farms are owned free of debt, and that all the mortgages on actual farms in the whole United States to-day do not exceed the value of one year's hay crop.

"The whole truth will be known when the census is completed, but enough is now done to indicate that the final result will differ from the above conclusions in amount rather than in proportion. A revulsion in public sentiment favorible to agriculture should follow a widespread discussion of these facts."—*American Agriculturist.*

How to Light Machine Shops.

At a recent meeting of the Institution of Mechanical Engineers, London, Mr. B. A. Dobson gave an interesting description of his experiences in shop lighting:

In endeavoring to improve the lighting of his shops at Bolton, Mr. Dobson naturally turned to electricity. Incandescent lamps were tried, but these were not a very great improvement in illuminating power over gas; while with the arc lamp the shadows were so hard and strongly defined that the workmen preferred a very much weaker illumination, if more diffused. When traveling on the Continent, Mr. Dobson visited some cotton mills, and here he found what seemed a very perfect system of illumination. Arc lamps were used, but they were placed in an inverted position to that which is usual, the negative carbon being above and the positive carbon below. This, of course, threw the greater part of the light rays upward, as most of the illuminating power proceeds from the crater of the positive carbon. The ceiling is kept well whitewashed, so that the light thrown up is again reflected downward. The sides of the room are also whitewashed, in order that a reflection may come from them. The result is that, without any definite source of illumination being observable, the whole room is flooded with a well-diffused light.

Mr. Dobson had very kindly arranged to have one of these lamps in the large visitors' room of the Institution of Civil Engineers, so that members were able to judge of its efficiency for themselves. The result was very perfect in regard to absence of shadows. One could stand in any part of the room, facing any way, and read a book or paper without any very perceptible shadow being thrown; indeed, the diffusion of light appeared to us as good as in the open air. Such a result is of the greatest importance, and it is to be hoped that libraries and reading rooms especially will in future largely adopt this system; or at any rate, that it will be introduced to the exclusion of the direct arc lighting, like that adopted with such unpleasant results in the reading room of the British Museum. In regard to cost, Mr. Dobson cannot speak positively on the subject, not yet having sufficient data to go upon; but he anticipates that it will be higher than gas at 2s. 8d. per thousand, which is the price in Bolton. There will, however, be a much larger volume of light than when the gas was used, and the advantages of the system, in his opinion, altogether outweigh any possible additional cost.

In the discussion which followed, Mr. A. P. Trotter gave a good popular explanation of the advantages of a dead white surface for reflecting light, as compared to that of a looking glass or bright surface. Good white blotting paper, he said, reflects back 82 per cent of the light cast upon it. Many persons are under the impression that looking glass must be a better reflector than paper or a whitewashed surface, because, with looking glass, a strong shadow can be cast, while from a dead surface no heavy shadow is obtained. The reason, of course, is not so much that the reflected light is less from the dead surface, but that the reflection is concentrated in the case of the looking glass. With paper or whitewash it proceeds from a vast number of points.

A modification of this system of reflected light, which is of interest, has been adopted by Mr. Aspinall, the chief engineer of the Lancashire and Yorkshire Railway, at the Horwich shops, where the rolling stock for the line is produced. In these shops the roof is not adapted for putting in larged whitewashed reflectors above the lamps, the jibs of traveling cranes, belting, shafting, etc., being in the way; but Mr. Aspinall, having seen the very perfect illumination obtained by Mr. Dobson at Bolton, determined to see if he could not obtain a modified result. He therefore inverted his arc lamps so as to get the positive carbon below, as in the case of the Bolton installation, and the major part of the light would be thrown toward the ceiling. Above the lamp, and therefore not shielding it from view, was a whitewashed screen of boards, acting as a reflector.

The effect was far superior to that of the ordinary method of arc lighting, where the dazzling stream of light pours upon the spectator, to the derangement of his eyesight, and at the same time casting heavy and impenetrable shadows. This arrangement, however, is inferior to the complete system, as described by Mr. Dobson, but may be taken as a very good substitute where, from local causes, the entirely reflected principle cannot be adopted.

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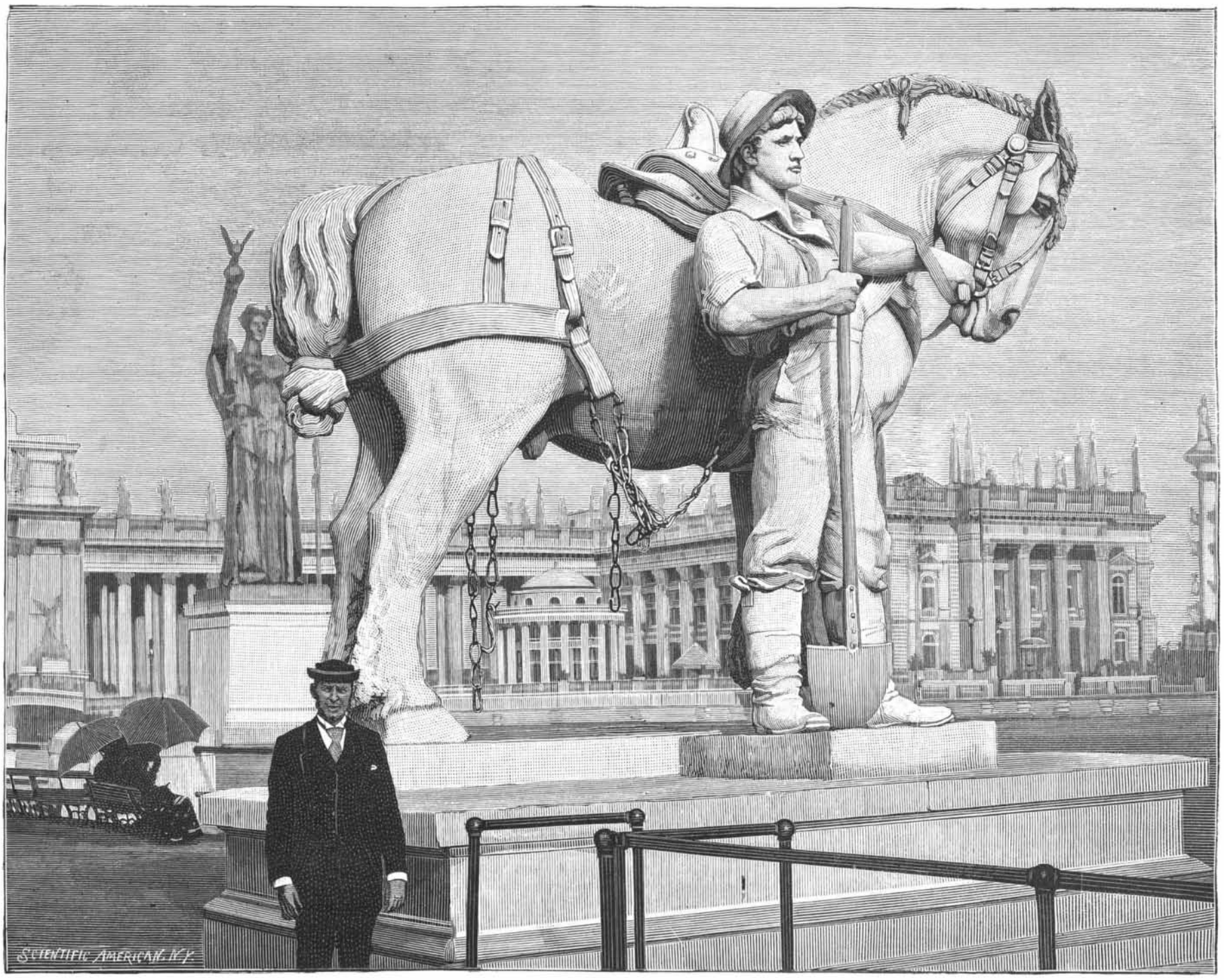
The Decimal Pointer.

In both France and Germany one-fourth reduced to a decimal is written as 0,25; in England it is written 0·25 (always with the period at the top of the line), and in the United States in this way, 0.25. France and Germany always use the comma, England and the United States the period, the only difference being the manner in which it is placed upon the line. Sir Isaac Newton is given the credit of originating the present English method of using the decimal point, his reason being that by placing it at the top of the line it could be distinguished at a glance from the "full stop" punctuation mark. All English mathematicians use the mark in the way proposed by Newton, and the period as a sign of multiplication.

THE COLUMBIAN EXPOSITION—STATUE OF "THE NORTH."

The main basin, which occupies the center of the Court of Honor at the Columbian Exposition, is decorated by several groups and pieces of statuary which possess real merit, as the sculptors have taken subjects which find their motives in American life. The statue of "The North," which is in front of the Manufactures building and near Mr. French's effective statue of the Republic, is a good example of one of these groups. The farm hand holds the powerful horse by the bit with one hand, while with the other he holds a spade. The man and the horse are of heroic size, and the group, when viewed either from the land or the basin, is very effective. At the extreme right one of the six rostral columns will be noticed. These columns are emblematic of victory, the projections in the sides representing the prows of captured triremes. The columns are surmounted by statues of Neptune.



THE COLUMBIAN EXPOSITION—STATUE OF "THE NORTH."

Directum, 2:05¼.

In a general way it is understood that Directum is the greatest 4-year-old, the fastest stallion and the best race horse the trotting turf has ever seen. But how completely he surpassed all previous trotters of his age can only be appreciated by a careful review of all of his performances during the present season. Such a review will not be attempted at this time, further than to outline what the California colt has accomplished, and how his record compares with others of like age. Directum has started five times against the watch and five times against competitors. He has proved himself a race horse and not one of the dress parade kind. The slowest mile that he has trotted in public this year is the 2:14½ in his opening performance to the old style sulky at Cleveland the latter part of July. He has lost but three heats, two to Walter E. and one to Pixley, and his fifteen winning heats in his five races were in the average time of 2:09.9. That is, all of Directum's miles are at a faster average than any one either in a race or against time by any 4-year-old up to the beginning of the present season. His fifteen winning heats average nearly a second faster than any other stallion of any age has ever trotted in a race. His twenty heats, in races and against time, are in the average time of 2:09½, which is faster than any 3-year-old trotter or pacer has gone up the present year.

Directum has trotted 10 miles this season at an average a trifle lower than 2:07½, which is faster than any other stallion has ever trotted a single mile under any condition. And so his superlative qualities could be enumerated almost without limit.—*Inter-Ocean.*

Lancashire Smoke.

Although Lancashire coal has a number of excellent qualities, yet it is one that makes the most smoke of any. A large portion of the Lancashire manufacturing industries, great and small, date from a number of years back, when smoke-consuming and smoke-preventing apparatus had not yet been devised; and many of the factories are working at the present day under pretty much the same conditions as when they started. Hence the atmosphere in all manufacturing towns in Lancashire is heavily charged with unconsumed carbon, producing an excess of cloud and fog, which, while inducing an excess of rain, acts also as a screen against the rays of the sun, and thus does a double injury to the neighboring agriculturist, the producer of the country's native wealth. A circle of thirty miles radius around Manchester is said to include a larger population than an equal circle around any other place in the world; and within this circle, about twelve miles northwest of Manchester, lies Bolton, the town with which the author is best acquainted, where all winds, except the west and northwest, bring the surcharged atmosphere from other manufacturing districts, producing at any season of the year, if the wind happens to be slight, a sky ranging from dull lead to dark brown. For four years in succession it has occurred at the writer's works that on June 21, the longest day, the gas in every room, amounting to nearly 7,500 jets, has had to be lighted by eleven o'clock in the morning, and remained lighted until work ceased; and this has occurred also in other towns, in weather that ought to have secured abundant sunshine. To such an extent does gloom prevail, that in clear weather the effect of bright sunlight becomes even distressing to the eyesight, simply from the rarity of the contrast.

One Million Pounds of Sugar in One Week.

Mr. L. Godchaux's Elm Hall refinery barreled up 1,000,000 pounds of sugar recently, the production of seven days' grinding. About 900 tons of cane per day passes through the rollers, 40,000 pounds of granulated sugar falls from the vacuum pans every six hours, and under the skillful management of Mr. Eddie Godchaux there is no let-up in this vast aggregation of machinery, not for a minute; with 500 men under his supervision, not one hesitates, but all know their duty and do it by some kind of instinct, as it were.

During the day a hundred wagons feed the maw of this monster mill with cane, and at night 500 cars are pulled in with a thousand tons of cane to appease the ever-crying call for more cane. About eight miles of railway are required to handle this vast crop. A Baldwin locomotive, with Mr. Clarke at the throttle, will take the place of mule propulsion in a few days; yet with all this immense acreage and all this cane to handle the indomitable enterprise of the manager has led to the incorporation of about 300 acres more of new land, and even now can be heard the terrible blasts of dynamite operating with fatal effects on the stumps that block the progress of the plow. If any one were to mention the fact that this country was now in the throes of a great financial panic (that is, in this section), he would be sent to an asylum for safe keeping. Times were never better, and altogether prosperity is on top, and everybody is happy.—*N. O. Times-Democrat.*

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RECENTLY PATENTED INVENTIONS.

Engineering.

HYDRAULIC DREDGING MACHINE.—John W. Sackett, St. Augustine, Fla. This invention provides a dredger and accompanying apparatus adapted to plow in the bed of a watercourse a furrow, to be deepened by excavator teeth and hydraulic jets, removing the excavated material with a modicum of water through an adjustable conduit that is the feeder of a pump on a float, the raised material being discharged at a preferred point. The invention also provides novel and simple means for the support and adjustment of the excavating mechanism, and a novel speed mechanism for the dredging apparatus to regulate its degree of advance in locating the plowing and elevating devices.

STRUCTURAL HOLLOW SHAFT.—Samuel H. Johnson, Pittsburg, Pa., and Harold C. Stowe, New YorkCity. This invention is for an improved means of producing a composite hollow shaft for steamboats and other purposes, which shall be of equal density throughout, adapted to resist transverse and torsional strains, and one which will be cheap to manufacture, light and easy to handle, and may be easily repaired. The improvement consists in forming a comparatively large shaft from a number of formed plates secured together to break joints laterally and longitudinally, re-enforcing the plates by internal junction sleeves, and stiffening the structure by the introduction and fixture of transverse diaphragm walls. The shaft also has solid cylindric journal stub ends, and any desired number of intermediate solid cylindrical bearing supports.

Railway Appliances.

CAR AND AIR BRAKE COUPLING.—Gabriel Rohrbach, Del Rio, Texas. This is a combination device adapted to automatically couple cars, which may be uncoupled from the top or sides, and also to automatically couple the air pipes as the cars come together. The car coupling is similar to a former patented improvement of the same inventor, and the drawhead has a rocking jaw, behind which is a socket with which an air brake pipe is connected, a link having a longitudinal bore and a head to engage the rocking jaw and enter the socket, a lever mechanism releasing the jaw.

Electrical.

TROLLEY LINE CONSTRUCTION.—Geo. Q. Seaman, Brooklyn, N. Y. Supporting devices having rocking and pivotal connection with the supports are provided with contact and insulated faces, and a switch bar or circuit closer on each support is held normally in electrical contact with the supporting devices, the switch bars having independent connection with the feed bar of the line. The trolley wires are connected with opposing supporting devices to form a series of sections, the wire of each section while under tension normally maintaining its supporting devices in engagement with the switch bars, whereby, when a trolley breaks, its supporting devices will turn and present their insulated faces to the switches, the broken section thus becoming immediately insulated, preventing the wire from doing harm. The cutting out of the broken wire can also be effected without disturbing the circuit at either side of the section.

MAGNETIC PERMEAMETER.—Edgar D. Knap, Schenectady, N. Y., and Severn D. Sprong, East Greenbush, N. Y. This is an instrument to test iron used in the field magnets of dynamos and motors, to determine its magnetic permeability. Combined with a field magnet having oblique pole pieces is a soft iron armature turning between them and having oblique wings or arms, the pole pieces being arranged diagonally opposite each other, and the wings of the armature being also diagonal, to avoid short circuiting. Polar extensions are formed on or attached to the poles of the field magnet to form contact with the iron to be tested.

Mechanical.

MACHINE DIE.—Aimé Vuillier, Millis, Mass. This is an improvement applicable to punching machines or drop presses, for setting rivets, and particularly for riveting ears upon pails or similar articles, affording means for securing a pail ear in place on the body by one stroke of the machine, in a neat and rapid manner. It comprises an upper composite die, with die block, punches, stripper block, keeper sleeve, etc., and a composite lower die, with upright anvil bocks, spring clasping device, adjustable gauge plate, etc. The cylindrical anvil blocks in recesses in the lower die block are preferably permanently magnetized, to adapt them to hold rivets on their upper faces secure from accidental displacement.

BORING TOOL.—Josiah W. Batcheller, St. Joseph, Mo. This is a tool for enlarging and smoothing bores already made, as the bores of gun barrels, turning out a shaving instead of simply scraping the walls of the bore. It may also be used for choking the barrel and operated by a machine or an ordinary hand brace. It has an elongated stock with an open recess at one side and transversely slotted at the ends of the recess, separable blades being pivoted in one of the slots and adapted to swing into the other, a screw threaded in the stock being adapted to enter between and separate the blades. A turning rod with flattened end is loosely secured in the slotted end of the stock.

NUT LOCK.—Joseph Harmon and George W. Faber, Duluth, Minn. The bolt, according to this improvement, has cupped indentations in the bottom of and between the threads, and on the nut is a spring limb whose free end successively enters the indentations when the nut is screwed on the bolt thread. On the nut is a post and a key adapted to engage it, and by partial rotation lift the spring limb and release the nut. The improvement is especially applicable in securing fish plates upon rails and other like uses.

STONE SAWING MACHINE.—Antoine Jeansaume, Paris, France. Drums mounted on a traveling frame carry flat-lying saws, and shafts arranged on the frame transversely to the saw blades carry grooved rollers adapted to bring the blades into working position, springs bearing against one end of the shafts and cams contacting with their other ends. The machine is adapted to quickly saw marble and other blocks of stone into slabs of any desired thickness or to cut profiles.

PRINTING MACHINE.—William M. D. Turton, Philadelphia, Pa. This is a machine designed for printing any desired pattern on textile fabrics, oil cloth, paper, etc. It has an endless traveling feed belt carrying the fabric to be printed, series of pattern cylinders, fountain rollers and inking rollers, the latter supported by rigid pivoted arms, motion being transmitted to the feed belt, cylinders and rollers by worm cog gearing, pulleys and belts. At the end of the pattern cylinders is a sprinkling device for dusting the printed material.

PLUMBER'S TACK.—William H. Evory, Brooklyn, N. Y. This is a tack adapted to be quickly and firmly clamped around pipes of different sizes to hold the pipes securely on the side of a wall. It comprises two separable leaves, a catch holding the leaves connected and bands attached to one of the leaves and to a rotatable shaft journaled in the other leaf.

IRON OR STEEL PILE.—Alexander Hooven, Norristown, Pa. An improvement in the piling of iron has been provided by this inventor, whereby scrap iron and steel may be brought into proper convenient form to be placed in the furnace and heated before being subjected to the rolls. The improved pile consists of a number of tubular sections telescoped loosely together, keys being driven into spaces between the sections to lock the sections together.

Agricultural.

SULKY PLOW.—Stephen E. Calif, Wilson, Mo. This is an improvement in plows, having wheels mounted on crank axles adapted to swing in a horizontal plane, the axles being connected by rods so that they swing in unison to facilitate the turning of angles. The implement has three supporting wheels of different sizes, and an adjusting lever is connected with the plow shank, whereby it is raised and lowered, while the sectional construction of the beam allows the plowshare to remain in the ground and yet permit the plow to be turned to the right or left.

COTTON SCRAPER.—William Lum, Carthage, Miss. An implement adapted for attachment to a plow having a removable point has been designed by this inventor, the scraper being also adjustable upon itself as well as upon the plow, so that it may be used to scrape a field without necessarily cultivating the crop by disturbing the ground. The scraper has a straight upper and inclined lower edge, a curved fender being adjustably secured to its upper forward corner. The inner edge of the scraper registers with the landside of the plow, and its upper edge in rear of the fender registers with the lower edge of the mould board.

Miscellaneous.

COIN CONTROLLED APPARATUS.—Richard M. Shaffer, Baltimore, Md. By the insertion of a coin or token into the coin slot of this apparatus an operating rod is thrown into operative connection with a hammer, and means are provided for dividing the coins. The coin chute leads down to a switch, which operates automatically to deliver the coins alternately into different receptacles, the coins in one receptacle being the compensation of the owner of the machine, and those in the other receptacle going to form a "pot" or pocket, the ownership of which is decided by the automatic opening of a door giving access thereto.

STOVEPIPE FASTENER.—Adam P. Fedewa, Belding, Mich. A pipe connection for fastening stovepipes in chimney holes has been patented by this inventor, one end of the connection being inserted in the chimney hole and the stovepipe inserted in the other end of the connection tube. The latter is longitudinally divided, and an expanding and contracting device of pivoted levers connected with it at its opposite ends and on opposite sides of its division, the device being adapted, on turning a screw shaft, to spread one end and contract the other end of the connection.

EARTH CARRIER.—James J. Wishard, Watsonville, Cal. This invention relates to an improvement upon a ditching machine, formerly patented by the same inventor, and provides a novel form of earth elevator for conveying the earth from the plow to the body of the ditcher and a novel form of belt for delivering the earth to one side of the road, the belt being so made that a heavier load can be carried than heretofore, and a lighter frame employed to support the belt.

HARNESS.—Harvey Stout, Fairmount, Ky. This inventor has provided a simple, cheap and light harness, which may be easily put on, and is so made that the horse may be instantly hitched to the shafts; the drawing strap and traces exert no friction on the breast of the horse, and means are provided for instantly unhitching the horse from the vehicle to obviate danger in case of an accident or runaway.

WINDOW SHADE HANGER.—John A. Thompson, Howard, Kansas. This device comprises guides to be secured to the window frame, a shade roller carrying bar and slides fitted to slide on the guides and provided with spring loops to receive and hold the ends of the bar. With this improvement a window shade and its bracket may be raised or lowered quickly and conveniently, so as to leave any portion of the upper or lower half of a window uncovered, and, no matter in what position the shade may be placed, it may be adjusted as readily as when hung in the usual manner.

MEAT COOKING DEVICE.—Adam Reubold, New York City. A vessel partly cylindrical and partly coniform has a flange around its upper edge to which may be attached a hollow cup piece in such a way as to make an air-tight joint, the general form of the vessel being such as to accommodate a ham or shoulder of pork or other article, and hold the meat from becoming loose in cooking, which is effected by placing the closed vessel with its contents in boiling water. In cooking by means of this improvement, the juices are not diluted, and all the aroma and distinctive flavors of the meats are saved, the meat being rendered tender and rich without shrinking in bulk.

PULLEY LINE HANGER.—Herman Reichwein, New York City. This hanger, when not in use, may be readily removed from the window frame and stored in small space, and when attached to the window frame it may be carried directly into the room, connected with the pulley line, and held in the room until all the clothes have been pinned on the line, when it may be carried out of the window and locked in position to stand at a right angle to the frame, the slack of the line at the same time being taken up.

PIANO ACTION.—James F. Conover, New York City. In this action a rocker is adapted to be pivoted to the key, and a spring-pressed arm pivoted on the rocker is designed to engage the pivot end of the hammer, a fixed rod held on the key engaging the arm. With this improvement the hammer can be forcibly propelled to the string from intermediate points of its travel for readily executing reiterating tone passages without the action resuming its normal position after each percussion, thus forming a double repeating or grand action and insuring greater speed and force of the hammer. An instantaneous automatic adjustment is effected by repeated strokes of the key.

HEATING APPARATUS.—Beniah M. Dunson, Kenton, Ohio. A simple funnel and drum attachment for an ordinary heating stove is provided by this inventor, the pipe having a pipe extending transversely across it, and a hot air pipe within the stovepipe extending outward through the transverse pipe, while a perforated drum surrounds the stovepipe. The attachment does not interfere with the draft or the ordinary heating capacity of the stove, but is adapted to collect the heat radiated by the pipe and conduct it to a room above.

ROOFING.—Charles E. Pope, Millville, Ark. A roofing board forming an improved article of manufacture is, according to this invention, formed with a groove in one edge, and an opposite tongue of greater width on the upper than on the lower side, the upper face of the tongue being provided with a groove, and the top face of the board having side channels and a center channel. A simple and efficient roof may thus be made at a low cost, requiring but a single layer of boards, or it may be covered with other roofing material.

SHEET METAL CAN.—Frank H. Palmer, Brooklyn, N. Y. An annular cone shaped flange is spun or struck up from a single piece of sheet metal, according to this invention, and fastened to the open end of the can body, the flange forming a seat for the cover and having its upper and lower ends doubled for connection with the can body, the lower doubled end forming a seat for the lugs of the bail, to permit the latter to draw the cover onto the flange and lock the cover in place. A can body so formed is strengthened at its upper end, and the separate soldering of the overlapping sides of the flange to form a joint is avoided.

HANDLE CLAMP FOR BROOMS.—Patrick H. Lynch, New York City. This is a device especially adapted for use with street and stable brooms, for readily connecting and disconnecting the handle and the head, reversing the broom when desired to insure even and regular wear. The back of the clamp has depending lugs or flanges at its front and rear edges, those at one edge being provided with clamping screws, and on the back is an inclined socket, in the rear of which is an inclined split clamping sleeve and screw, a scraping prong or finger for loosening any object projecting upwardly and forwardly from the socket.

VEHICLE BRAKE.—Stephen E. Odell, Grayling, Michigan. This device is especially adapted for use with bicycles, causing no sliding friction on the tire, but being designed to keep the latter in its natural shape, even when the strongest pressure is applied. On the head a brake staff is held for vertical movement, and when pressed downward a roller contacts with the periphery of the tire of the wheel, with which it turns, a brake shoe immediately afterward being brought into frictional contact with the roller, the interposed wheel thus sustaining all the sliding friction.

COOKING APPARATUS.—George H. Nicholls, Galveston, Texas. Within an ordinary saucepan is placed a vessel having perforated bottom and sides, and a fibrous envelope of muslin or other material is held against the inner walls of the perforated vessel by means of a skeleton frame. The apparatus is especially designed to facilitate the cooking of cereals, etc., that are boiled or steamed, enabling them to be cooked without danger of their burning in the absence of an attendant to stir them constantly.

TEA OR COFFEE POT.—Frederick Mann, London, England. Centrally in this pot is arranged a vertical grooved frame, in which slides a second two-part frame containing a strainer made of perforated metal, wire gauze, muslin, or other similar material, the frame being reversible and the strainer easily cleaned. A strainer thus arranged does not interfere with the free pouring of the infusion from the pot, and on account of its large surface the strainer may be made very fine without liability of choking up.

BUCKLE.—Louis B. Prahar, Brooklyn, N. Y. The back plate of this buckle has a central stud with enlarged head, and hinged to the back plate is a cover or latch plate adapted to snap over and frictionally engage the stud. The construction is simple, and the buckle may be highly ornamented to serve as a decoration of a belt, while being very quickly manipulated to lock or unlock the two ends of a belt.

DOLL MAKING.—Frank M. Scott and Abner F. Seymour, Brooklyn, N. Y. These inventors have provided an improved method by which nice dolls may be quickly and cheaply made. The busts are moulded in sections between convave and convex dies, their meeting edges formed with curved or interlocking portions, the sections being thus fastened together without overlapping engagement. Celluloid or any other pliable material may be used which is capable of being moulded and retaining its shape.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

FOUNDATIONS OF THE ATOMIC THEORY: Comprising Papers and Extracts by John Dalton, William Hyde Wollaston, and Thomas Thomson. Edinburgh: William F. Clay. London: Simpkin, Marshall, Hamilton, Kent & Co., Limited. 1893. Pp. 48. No contents, no index.

This little contribution to the history of chemistry, referring to the period of 1802–1808, and covering papers by Dalton, Wollaston and Thomson, will be read with much interest by those really interested in the science. It figures as the second of the Alembic Club reprints, and it cannot but be believed that its usefulness and interest would be greatly heightened by a contents and an index, both of which are wanting.

THE ENGINEER'S DIRECTORY. Compiled by Marlboro Stationary Engineers' Association. Marlboro, Mass. 1893. 18mo. Pp. 200. Price 50 cents.

This work is almost entirely devoted to advertisements, the useful information occupies a secondary place and only consists of forty-four pages.

SECOND REPORT OF THE BUREAU OF MINES. 1892. Toronto, Canada: Office of the Bureau of Mines. 1893. 8vo. Pp. 264.

A report containing an account of the progress made in mining and metallurgy for the year 1892. A description of the minerals exhibited at the World's Fair is the subject of an interesting paper. The peat industry also comes in for a share of attention.

MASSES AND CLASSES. A STUDY OF INDUSTRIAL CONDITIONS IN ENGLAND. By Henry Tuckley. Cincinnati: Cranston & Curts. New York: Hunt & Eaton. 1893. Pp. 179. Price 90 cents. No index.

This little work is devoted to the English bread winners, the toilers by the Thames, the street drivers, clerks, shop assistants, London working girls and others. The author says that these English bread winners are our own kindred, and argues that we should be informed of their situation and needs. The additional factor obtains that we are rapidly approaching a time when we may find our own cities in the same condition of overcrowding and extended pauperism. A very full table of contents excuses to some extent the want of an index.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER, 1893.—(No. 97.)

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1. Elegant plate in colors showing a residence at Bridgeport, Conn., recently erected for Mr. Thos. C. Woodin, at a cost of $4,600 complete. Floor plans and two perspective elevations. An excellent design. Mr. Henry A. Lambert, architect, Bridgeport, Conn.
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8. Engraving showing some city dwellings of modern design at Washington Heights, New York City. Plans and perspective views. Mr. W. E. Mowbray, architect, New York.
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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5531) C. D. A. desires to know what chemicals and what proportion of each are used in a preparation called chemical ink eraser. A. Take chloride of lime 1 pound, thoroughly pulverized, and 4 quarts soft water. The above must be thoroughly shaken when first put together. It is required to stand twenty-four hours, to dissolve the chloride of lime; then strain through a cotton cloth, after which add a teaspoonful of acetic acid (No. 8 commercial) to every ounce of the chloride of lime water. The eraser is used by reversing the penholder in the hand, dipping the end of the penholder in the fluid, and applying it, without rubbing, to the word, figure, or blot required to be erased. When the ink has disappeared, absorb the fluid with a blotter.

(5532) M. S. Y. asks: 1. Is that end of the magnetic needle which points toward the north pole of the earth the north pole of the needle? A. It is generally so termed, but the earth's N. magnetism is the opposite of that of the N. end of the needle, otherwise there would be repulsion instead of attraction. 2. What is the object in having the zinc in the gravity battery shaped like a crowfoot? Would not a square or circular plate give as great E. M. F.? A. The E. M. F. has nothing to do with shape. The crowfoot shape facilitates cleaning. 3. Is the gravity battery suitable for an open circuit? How many cells would be required to ring a small door bell? A. No. Three cells are ample as long as in condition. 4. I have a bichromate four-cell battery, which gives a powerful current for about an hour, then stops action. After cleaning elements and amalgamating zincs it works as well as before. What is the matter, and is there any way of preventing the sediment accumulating on the elements? A. Your battery should not accumulate such a sediment. Perhaps your solution is wrongly made. The battery probably becomes exhausted. This is of course inevitable. Larger jars will, by holding more solution, give the battery more durability. 5. How to clean rust from nickel plating? A. Use electro-silicon or putz pomade. You will wear the nickel, but that is unavoidable.

(5533) S. C. H. writes: 1. Can you tell me the easiest and best way to patch rubber, as the inner tube of pneumatic bicycle tires? Have some trouble to make ordinary "tire tape" adhere to the tube, and rubber dissolved in benzine, while it forms a film, does not unite with the tube fabric. A. Rub the inner tube with emery cloth or sandpaper at the place to be patched. Put on some *good* rubber solution. Prepare your patch in like manner with rubber solution. It is well after the solution is dry, in fifteen minutes or more, to repeat the application, not using the emery cloth, however. Then, after the solution has dried completely, put the patch on and rub it well down. Dust on some talc, or chalk it well, before replacing. For an emergency use one application only. The great point is to have the surface dry before putting on the patch. Use only the best rubber cement or solution. Do not try to make it yourself. It is well also to apply benzine before putting on the solution. 2. Is there any good work on the care, filing, and scientifically practical use of saws? A. We can supply, by mail, Worssam's "Mechanical Saws," $2.50; Holley's "Saw Filing," 75 cents; Grimshaw's "Saw Filing," $1; Oldham's "Why Band Saws Break," $1. 3. Can I arrange an electric call bell to operate in connection with and over same wire with an acoustic telephone wire, all out of doors and about 300 feet long? A. If you see that the wire is properly insulated at the points of support, you can use it as described.

(5534) R. C. B. asks: Will you be kind enough to let me know if any railroad train or engine has ever covered ninety miles in one hour? I don't mean run at the rate of ninety miles an hour, but has gone from one given point to another which were ninety miles apart in one hour. A. We think there is no record of any train time nearly as great as you state for a distance of ninety miles.

(5535) G. D. C., Conn., says: I mail you a twig cut from a tulip tree in my yard. In the early part of the season the tree was infested with green lice and later by this—whatever it is. Will you kindly give me the name of the insect and a remedy for it. The tree is quite a large one and I do not like to lose it. Some of the branches are now devoid of leaves and seem to be dying. Reply by Professor Riley.—The tulip twig sent has upon it a number of common tulip scale insects, *Lecanium tulipiferæ*, Cook. This insect, like others of its class, is protected by a scale, a resinous excrescence over the surface of the body, which in this species is brown and very convex above, and has on the underside a cotton-like secretion common to all members of the genus, which serves to inclose and protect the eggs. In general form this scale is not unlike a turtle in appearance when mature. The numerous small yellow eggs are deposited beneath the scale, and, after hatching, escape and disperse to all parts of the tree, fixing themselves and ultimately developing protecting scales of their own, beneath which they extract the juices of the plant by means of a long proboscis. An interesting fact in connection with this scale insect is the secretion by it of a quantity of sweet liquid, the "honey dew" of the Aphides, which, in the case of scale insects, is rarely produced in very great quantity. With this species, however, it is so abundant that they are frequented by honey bees in large numbers and a great deal of inferior honey is stored up wherever this insect is abundant. This honey, like the honey produced from Aphides, in addition to its very inferior quality, is objectionable in that it candies almost immediately after being stored up by the bees in their cells. The remedy for this scale insect consists in the use of kerosene emulsion at the time of the hatching of the young, as hitherto recommended for similar cases in these columns. It is doubtful whether the trees will die, however, even without treatment, as the parasites of the coccid prevent its continuance in destructive numbers.

(5536) T. H. C. says: There is a method of making a light glow light by means of phosphorus and sweet oil, sufficient to make out the hands of a watch at night. A. Phosphureted oil is the best means of exhibiting the luminous properties of phosphorus. A small piece of dry phosphorus, about the size of a pea, is placed in a test tube with a little pure olive oil. The test tube is held in the water bath until the oil becomes heated and the phosphorus liquefies. It is then shaken until the oil will take up no more phosphorus, and after allowing the oil to become clear, it is poured off into a small glass vial provided with a glass stopper. Only a small quantity of this oil in the bottom of the vial is necessary. When it is shaken about so as to coat the sides of the vessel, and the stopper is removed so as to let the air get in, the oil-coated sides of the glass become at once luminous, and continue so as long as the stopper remains out. Characters written on paper with oil thus prepared (freshly) appear in the dark very brightly. Phosphureted ether is prepared by digesting phosphorus in ether for some days in a tightly stoppered bottle. A piece of sugar dipped into this ethereal solution and then thrown into water makes the surface of the latter appear quite luminous in the dark. Young experimenters must remember that phosphorus is very dangerous to handle when out of water, and often inflames spontaneously when exposed dry in the air. 2. Also the formula for soldering fluid, made of muriatic acid and zinc with muriate of ammonia? A. This liquid, which causes no rust on iron or steel, is prepared by cutting zinc into small pieces, dissolving in hydrochloric acid until the acid ceases to bubble. Add about ¼ part of the solution of ammonia, which neutralizes the acid. Dilute the whole quantity of liquid with an equal quantity of water. The information given above is from the "Scientific American Cyclopedia of Receipts, Notes and Queries."

(5537) S. J. S. asks: 1. In either a gentle breeze or a violent storm, where is the power that propels the air—in front or in the rear? A. The gentle breeze is the natural drift of the air, either toward a region of low pressure or it may belong to the general circulation of the atmosphere due to equatorial heat lifting the air to flow off toward the poles. In the first case the cause of motion is in front, while in the second case it is in the rear of the course of the wind. Storm winds are largely local, sometimes blowing toward a center of heat rarefaction, which carries the central portion upward and draws the surface air toward the center. 2. What gives to a cyclone its whirling motion, and where is the power that propels it—in front or in the rear? A. Storms of a whirling character, as some of the great storms originating in equatorial regions and tornadoes, are generally started by an upward central flow due to excessive heat, which draws the air violently toward a central region and sets the wind into a whirl—the direction of the whirl being controlled by the resultant of the motion of the earth's surface in its revolution and the direction of the antitrade current in the upper atmosphere. The propelling power that moves the cyclone along its path is probably behind it and in the great body of the antitrade wind. The power that produces the whirl is probably central and in front. 3. What causes clouds to move in any given direction? Is the power that moves them in front of them or behind them? A. The clouds' movement is with the wind in which they are suspended, and they have the same cause of motion as the wind. See a most interesting work on physical geography by Houston, $1.25 by mail.

(5538) F. J. M. asks: 1. What is the best way to nickel plate zinc? A. For the nickel bath for zinc: To 6 gallons water add 2 pounds double sulphate of nickel and ammonium, 7 ounces sulphate of ammonium, dissolve by boiling. Cool and test for acid with blue litmus paper; if found, neutralize with hydrochlorate of ammonia. 2. What is the best way to silver plate steel knives? A. For the silver bath for cutlery, for 1 gallon water dissolve 5¼ ounces nitrate of silver; add gradually in solution, 8 ounces cyanide of potassium. 3. Will you give me the best method for tin plating or tin dipping for knives and forks? What I mean is dipping in molten tin and have them come out smooth, or if anything can be put in the tin to make it come out smooth. Also will you give me a formula for a good copper plating solution, also a brass solution. A. For the tinning process, dip the clean articles in a hot solution of muriate of tin, dry quickly, and dip in the melted tin bath. All the various processes and receipts for nickel, silver, and tin plating, as also for copper and brass plating by the electric and dipping methods, are detailed in the "Scientific American Cyclopedia of Receipts," $5 by mail.

(5539) J. R. R. asks (1) how the proportions of large induction coils are calculated. A. The general rule for induction coils is to make the ratio of turns of secondary and primary proportional to the increase of voltage desired. To increase from the voltage, in the primary to one thousand times as great voltage, one thousand times as many turns are given the secondary as are in the primary. This rule is, however, far from perfect. 2. Must the secondary wire be silk wound? A. No. Bare wire is often used, wound carefully, so that successive layers will not touch. 3. What is the capacity of condensers to be used for them? A. Do not calculate, but follow proportions of some successful coil. See our SUPPLEMENT, Nos. 160, 569, 229, 166, also SCIENTIFIC AMERICAN, No. 14, vol. 66, for coils and apparatus connected therewith. The whole subject is usually treated rather empirically.

(5540) W. J. L. asks: 1. Can a motor be run by gravity battery? If so, how many cells would it take to run motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641? A. A gravity battery is not suited for the purpose, on account of its high resistance; try plunge battery described in SUPPLEMENT No. 792. 2. Does increasing length of wire in armature coils increase or decrease voltage of a dynamo, and to what extent? A. It increases it if the field is kept excited to the same extent as before. Yet it is possible that increase of length of armature wire may reduce the current so as to interfere with the excitement of the field and so cut down the lines of force sufficiently to reduce the voltage.

(5541) J. G. Von H. writes: 1. It is said that there are only two kinds of electricity—static and dynamic. Is the induced electricity from an induction coil static? If not, what is the difference between static and induced electricity? A. There is really only one kind. Static electricity is used to express electricity at rest, dynamic electricity to express electricity in motion, or re-establishing equilibrium of potential. In the popular conception very high tension phenomena are generally referred to static electricity. 2. What is the most injurious to mankind, 500 volts ½ ampere, or 500 volts 10 amperes? A. The discharge last named is practically an impossibility. High and rapidly changing voltage is the most injurious type.

(5542) F. J. S. says: I have a double simple compound condensing engine, two high pressure cylinders, 3 inches diameter, two low pressure cylinders, 6 inches diameter, by 4 inches stroke. With 100 pounds steam, what size and pitch of propeller should I have? A. The double compound engine at the pressure stated will run a propeller wheel 36 inches diameter, 48 inch pitch.

TO INVENTORS

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November 21, 1893,

AND EACH BEARING THAT DATE.

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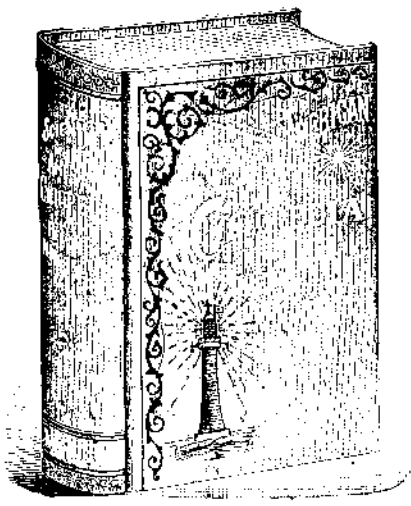

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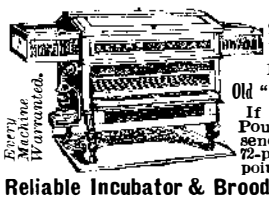

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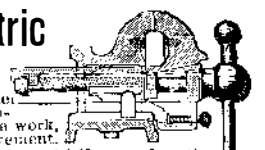

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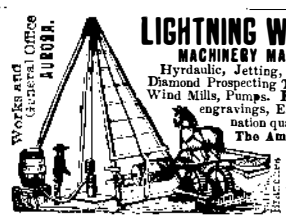

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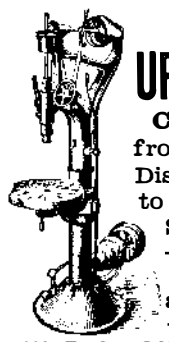

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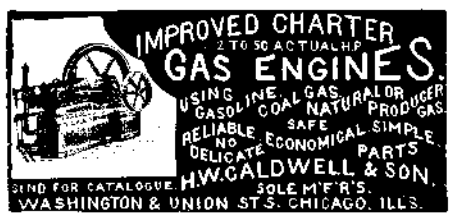
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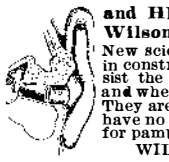
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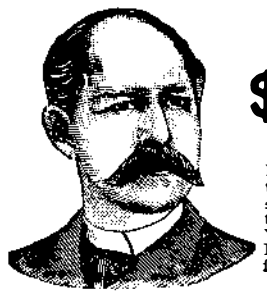

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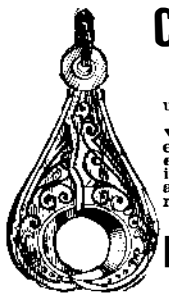

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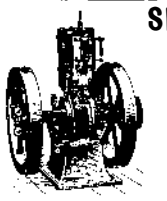

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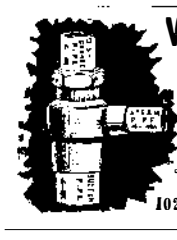

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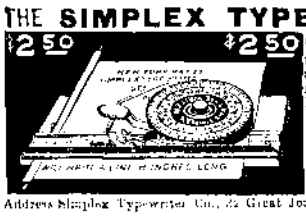

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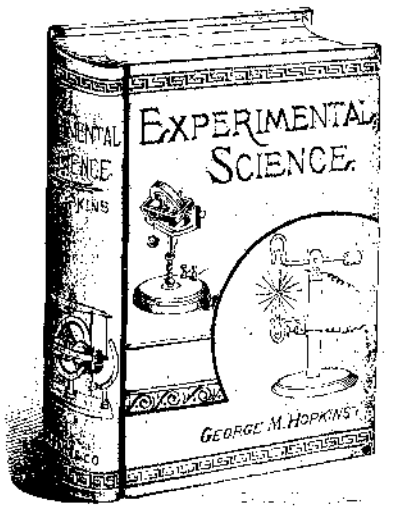

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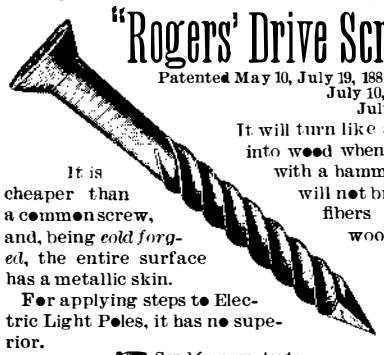

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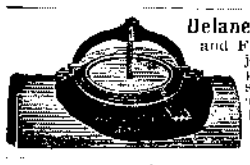

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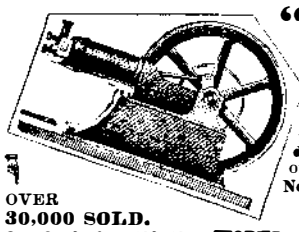

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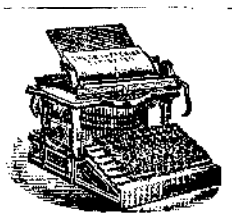

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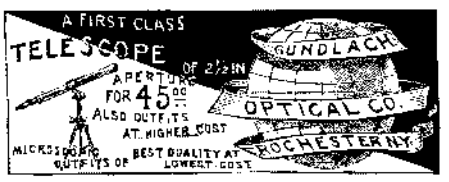
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